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“It will flourish, if naturalists, chemists, antiquaries, philologers, and men of science in different parts of *Asia*, will commit their observations to writing, and send them to the Asiatic Society at Calcutta. It will languish, if such communications shall be long intermitted; and it will die away, if they shall entirely cease.”

SIR WM. JONES.

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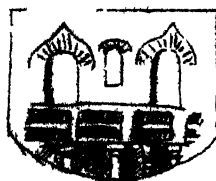
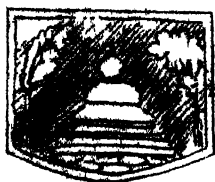
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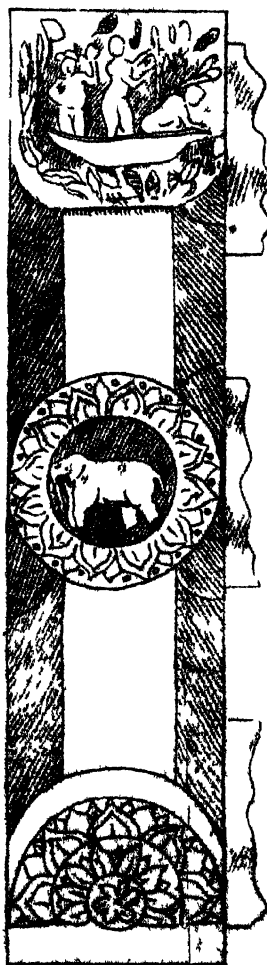
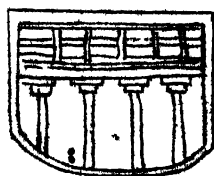
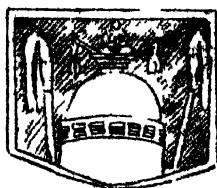
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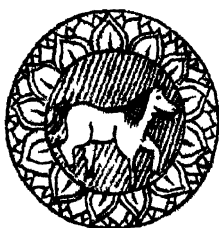


*Our views on tops of rock piers at Buddhas Canyon*





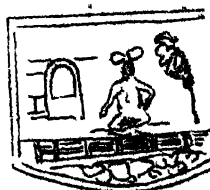
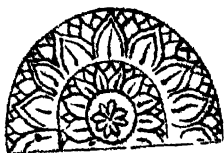
*Ornaments on Real Posts at Buddha Gavi*



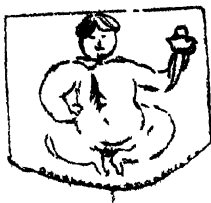
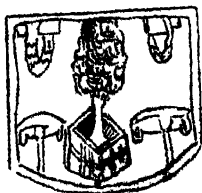
*Middle ornaments*



*Bottom ornaments*



*Top ornaments*



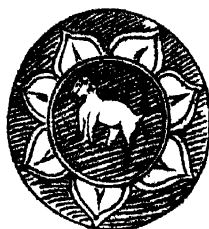
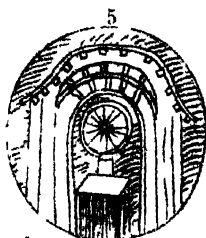




*Carvings on rail posts at Bodhiha, Gaya.*



*Middle ornaments*



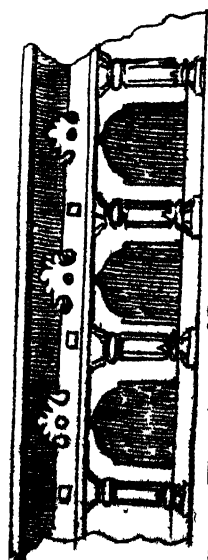
*Middle ornaments*



*Top ornaments*



*Devan face*



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# JOURNAL OF THE ASIATIC SOCIETY.

PART I.—HISTORY, LITERATURE, &c.

No. III.—1867.

*On the Arabic Element in Official Hindustani.*—No. 2. By  
J. BEAMES, Esq., B. C. S.

[Received 23rd July, 1866.]

“If Hindustani, adopted by us as the future general language of India, is to be a language and not a jargon, it must become so by means of its alliance with Persian, the speech which all Indian Mahomedans have at their heart, and use as the feeder, or channel of other feeders, for all their abstract thought, their politics, science, and poetry.”\*

This extract serves as a fitting text to the subject which it is my aim to illustrate. In a former paper I gave an outline of some arguments in favour of the present Arabicized dialect of our courts, and as the little literature which the language possesses is written in the same style, the following remarks may be considered as applicable to the literary style also. In the present I propose to review the assertions of the upholders of the opposite opinion, which may briefly, and I trust fairly, be stated thus:—In writing or

\* Quarterly Review No. 234, page 517 on “Vámbéry’s Travels in Central Asia.”

speaking Hindustani, if you have two words to choose between, one Hindi or Sanskrit, and the other Persian or Arabic, it is better and less artificial to use the former; and the Arabic and Persian words already in use in Urdu are for the most part wrongly used, and are often very corrupt forms of the genuine words. There are thus two arguments: the first, a political; the second, scientific. I will examine the political or historical argument first. But I must premise that I consider the whole question as one for the student rather than the statesman. Dr. Fallon, a vigorous partizan of the Hindi school, writes, somewhat complacently, thus: \* “The Urdu language needs direction; but the natives have neither taste nor learning for such a work. The task must be performed by European scholars, and the Government of the country.” I would ask the author whether, in all the range of his comprehensive reading, he has ever met with an instance of a language having been created or guided by foreign scholars, or licked into shape by a Government. Is language, like law, a political creation? Does it not rather grow up in the homes of the people? Is it not hewn out of their rough untutored conceptions? Does not its value consist in its spontaneous and unconscious growth? Are not its very irregularities and errors, proofs of the want of design that attends its formation?

Or again, can a stranger guide the native mother in choosing how to talk to her child? If it be difficult for foreigners to influence a language in a country where women enjoy the same freedom as men, how much more hopeless is the task in a country like this, where the mothers of the people are inaccessible and invisible?

No, we cannot influence the speech of this people; they have formed it for themselves; they have, before we came on the scene, chosen Arabic and rejected Hindi. It is not true to say that they prefer Hindi, and that we have forced on them Arabic. It is not correct to say that pedantic munshis have created for the use of the European officer a dialect unknown to the majority of the people, and the use of which severs him from them, and gives the keys of communication into the hands of a single class. The use of Arabic and Persian words pervades every class. I, and many other officers, know that

\* English-Hindustani Law and Commercial Dictionary by S. W. Fallon, Introductory Dissertation, p. xviii. ad fin.

when we go alone and unattended into a native village, we can converse readily with the commonest people; and I have found the Arabicized style, which I, from deliberate preference, always employ, quite intelligible to the ryot and the bunnia. This people formed their own language, and we may rest assured they will continue to develop it in that direction which they feel to be best. It is true that Hindi is the speech of the lower classes, but how many Arabic words have invaded even the lowest Hindi, because the national feeling has adopted Arabic as a sign of cultivation. The scholar may lament that it is so, just as some scholars lament the disuse of Saxon words in English, but the lamentations of the scholar do not hinder the progress of the language.

"Hindi is more native to the soil, and lies closer to the hearts of the people than Arabic or Persian, and its use is therefore preferable to that of the last named languages." This is the *political* argument of the Hindi school. Dr. Fallon\* puts it thus: "Hosts of Persian and Arabic words have been introduced *by natives of the country* (the italics are mine) who affect a foreign tongue, and make transfers in the mass out of worthless books imperfectly understood. The true vernacular is overwhelmed, thrust aside, and scornfully ignored." And again, "The vocabulary of the Indian Courts of Judicature is not absolutely without a few Hindi phrases. Still, a very large proportion of good Hindi is systematically excluded by ignorance or bad taste, or, worse still, from corrupt design. Words which are continually in the mouths of the people, the current speech in which men in town and country buy and sell and transact business, the mother-tongue of the peasantry and indeed of the great bulk of the nation is repudiated for a foreign, high-sounding phraseology. But a people's vocabulary is not so to be set aside. The few have seldom yet succeeded in substituting their language for the language of the many. Beaten off from the courts and public offices, native Hindi still lives in the busy mart, and in the familiarities of social and domestic life. In the pithy sayings, proverbs, and national songs of the country, dwells a spirit and an influence beside which the foreign and less familiar speech seems feeble and flat. These Hindi phrases have deep roots in the habits and associations of the people. They come

\* Dissertation pp. xii. xiii.



home to the feelings and the understanding of the highest and the lowest. They possess a living power, universality and force of expression, which can never belong to the Arabic and Persian platitudes that are thrust in their place."

Now all this is very good and very eloquent, but it rests on false assumptions. It assumes that what is true of some classes of the population is true of the whole. It puts aside entirely all the rank and education of the country—it puts the peasant on a pedestal, and requests us to accept the barbarous and antiquated jargon that falls from his lips as the model of our speech, and as the vehicle for the expression of intricate philosophical argument, close legal reasoning, delicate and refined discussion on art, science and politics.

A second erroneous assumption is, that we have to thank our law courts for the abundance of Persian and Arabic terms in use in Hindustani. The fact, however is, that our native clerks use nine-tenths of these words, simply because they have been used for five centuries past as legal terms, and use has conferred on them a conventional meaning, which no other words possess. The native press, in discussing matters of a purely unofficial character, uses the same phraseology. The style of Abul Fazl and the Sih Nasr-i Zahúri is the model of all native composition. And this arises not from pedantry or affectation; the reasons of it are to be sought, first, in the circumstances in which the early Musulman invaders found themselves; and, secondly, in the constitution of native society from those times to this.

Who, then, were the founders of the Urdu language? They were a mass of Turks, Tartars, Persians, Arabs, and Syrians; with whom were amalgamated many of the middle and lower classes of Hindus; principally, perhaps, the adventurous trader; who goes anywhere to gain money, and the idle scum who are always attracted by an army. If we further ask what were the materials from which this heterogeneous mass could compound a *lingua franca*, we find, of indigenous dialects, Sanskrit and Hindi; of extraneous ones, Arabic and Persian, and various Turkish dialects. They had to introduce a new religion, a new government; systems of policy and organization new to India; rules of etiquette; the social habits and refinements of a town life; new articles of clothing, furniture and luxury; philosophical terms; terms to express new processes in the mechanical arts.

To what source should they turn for words to express these ideas? The Brahmin and the Rájput stood aloof from the casteless strangers. Sanskrit therefore was probably very little heard in the camps of the Ghorí or the Khiljí, and still less in those of Timur or Baber.

Words of Sanskrit origin, but more or less mutilated, were heard from the lips of the lower classes, who also used a vast number of Hindi words, i. e. words either of Sanskrit origin or not, but so far altered from their original as to become new words.\*

Let us now go through some of the words which we may suppose offered themselves to the invaders as native terms to express their new ideas, and I think it will be seen that none of these words were really available.

In the first place the new religion was Islám. To express the religious duties of that pugnacious creed in anything but Arabic was profanation not to be thought of. Hence the introduction of *masjid*, *namáz*, *rozá*, *kitáb*, *íd*, and the words of this class were unavailable, for even putting aside the profanation, words of Sanskrit origin could not express, because they did not contain, the requisite ideas. If any one doubts this, let him think how far the Sanskrit and Hindi words written below represent the Arabic or Persian.

|               |                                                                                                                                             |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Masjid</i> | Sanskrit— <i>mandiram</i> , <i>deválayam</i> ;<br>Hindi— <i>dewála</i> , <i>maṭh</i> , <i>mandar</i> , <i>shiwála</i> , <i>ṭhákurbári</i> . |
| <i>Namáz</i>  | S. <i>prárthaná</i> , <i>nivedanam</i> ;<br>H. <i>pújá</i> , <i>páṭh</i> .                                                                  |
| <i>Rozá</i>   | S. <i>upavása</i> , <i>upásanam</i> , <i>abhojanam</i> , <i>langhanam</i> ;<br>H. <i>upás</i> , <i>langhan</i> .                            |
| <i>Kitáb</i>  | S. <i>pustakam</i> , <i>grantham</i> ;<br>H. <i>pothi</i> , <i>pustak</i> .                                                                 |
| <i>Id</i>     | S. <i>parva</i> , <i>utsava</i> , <i>yátrá</i> ;<br>H. <i>parab</i> , <i>tyohár</i> or <i>tehwár</i> .                                      |

Now it is at once evident that the adoption of any of these words, deeply tinged with the hues of the Brahminical creed, would at once have been fatal to the genius of Mahomedanism. These Sanskrit words therefore retained their place in the language with reference to

\* An example will make the distinction clearer : *Rájd* I should call a Sanskrit word, because it retains its form unaltered ; *bilmhána* I call a Hindi word because its connection with the Sanskrit *avilamba* is, though undoubted, yet not at first sight apparent.

the belief of the Hindu, while for the new Muslim population, the purely Muslim words were retained ; and as nothing was displaced to make way for them, they were a clear gain to the language, enabling it to keep pace with the new religious development of the nation at large. Secondly, words relating to the government of the country. The mass of little kingdoms each headed by its petty *rājā*, a puppet whose strings were pulled by his Brahmin ministers, was to give way to the rule of one supreme "father-king," *padshāh* ;\* who should parcel out his dominions into satrapies or *subās* ; and these powerful satraps again would divide their provinces into districts ; and the rulers of districts would portion them out into counties, and so on. Divisions of caste were to be ignored, all men were free and equal, on condition of paying their taxes duly. The sovereign acknowledged himself to be under no obligation towards his subjects. He was an absolute despot whose business was to rule, as his people's was to obey. He was, however, expected to be accessible to the meanest of his subjects at certain times, and on the whole to do justice, though after a somewhat random fashion. How utterly inapplicable to such a system and to such a ruler would be the Sanskrit title of *rājā* ; what a crowd of ideas and memories of another order of things would such a title bring with it. Would it not lower the great "father-king" to the level of the petty knights he had just destroyed ? But the word *rājā*, though inapplicable to the sovereign, was not discarded ; it remained as the title of a high order of nobility, as it is to this day, and the Persian terms indicative of sovereignty are therefore positive additions to the language.

It is unnecessary to go in detail through the long list of words relating to government introduced by the invaders. It is evident that a people's language can have no words for ideas or things which do not exist in the country. Especially was this the case in India. Excluded from all but the scantiest commerce with the outer world, India had long believed herself to contain the whole of the inhabited earth, or at least to be the centre and greatest part of it. Like China in the present day, India thought herself "the central flowery land," and had but dim notions of certain "outside barbarians" who led a miserable life on the confines of space. When the new era of a vigor-

\* I assume *Padshāh* to be "*pidr-shah*," father-king, like *Atabeg* or *Abimelech*.

ous civilization and progress dawned on her, she was unprepared to meet it. Her religion, laws, customs and language shrivelled up at once, and slunk into holes and corners, and the statues of her gods which had loomed grand and terrible in the twilight of Brahminism, looked poor, feeble scarecrows in the full blaze of el Islam. The conquerors were but little disposed to adopt the language of the conquered race, but even had they been so, that language afforded them no materials in which to clothe their ideas. Necessity stepped in to aid inclination, and the result was a language full of imported words.

"But," it may be urged, "no one objects to a certain number of Arabic and Persian words; many of them are necessary, some even indispensable, to the people: all we object to is the indiscriminate introduction of words which are not necessary, and for which the early Mahomedan invaders are not responsible." I might answer this, by asking the Hindi school to tell me how they know at what date any given word first made its appearance in India? On what grounds do they assert that the simpler and shorter Arabic words were introduced first, and the longer and more complicated ones later? There exists no regular Urdu literature by which we can, as in English, mark the exact epoch of the introduction of a word. And this brings me to my second argument, that, namely, derived from the constitution of native society, during all the years in which the Urdu language has been growing, up to the present time.

The conquerors were essentially one nation, though composed of very mixed elements. If they had adopted the language of the conquered, in a few generations they would have become scarcely intelligible to one another. In the present day an inhabitant of the Punjab just manages to make himself intelligible to a man of Patna by virtue of those few words which are now common to all Indian dialects, namely those of Persian origin, and the Hindi verbs and particles which have, thanks to the Mahomedans, become familiar all over the country. At the time of the first invasions *hond* was not used over a wider area than *bhá*, *pás* than *blíre*, *uská* than *okerá* or *wáká*. As the country was split up into a number of petty kingdoms, so was the language into a mass of dialects. Hindi was not one but many, and so it is to this day. The service which the Mahomedans rendered to India, consisted in their taking one of these many dialects

and making it the vehicle of their Persian and Arabic, and thus distributing it all over India. The Hindustani or Urdu language is therefore, from one point of view, not Persian grafted on Indian, but Indian inserted into Persian. The movement began from above and was imitated by the lower classes.

At an early period of the invasion, large tracts of country were converted to the Muslim faith. All the Punjab west of the Chinab, and a great deal east of that river; all the chief towns in the valley of the Ganges, and many villages in all parts of the country were largely converted; and the conversion went on for centuries, and has not yet ceased. To all these converts Arabic became a sacred tongue, and as such lay and lies as near the hearts of this section of the people as Hindi. Speak to a Mahomedan rustic in Hindi, he understands you and talks to you in the same; but speak to him in Urdu, and he will press into his service every word he knows of Arabic and Persian, to show you that though, through accident of birth, he can only speak a few words of those honored and sacred tongues, he is yet not quite without knowledge of them. The rustic father sends his son to school to the village pedagogue, to learn what? not Hindi, but Arabic and Persian. And then we are told that these languages do not lie near the hearts of the people! Why, I believe if the votes of the whole Mahomedan population could be taken, an overwhelming majority of them would prefer to abandon Hindustani altogether and make Persian the language of the land.

Among the higher classes in towns, who form the most intelligent and cultivated portion of the population, there can be no question whether Urdu or Hindi is most popular. It is in the towns that we find the stronghold of the Musulman, and consequently of Arabicized Urdu. But on what grounds we are asked to set aside the townspeople and all the Mahomedan rural population, together with all cultivated Hindus who try to talk as much Urdu as possible, I do not see. Native society has been for five centuries so thoroughly leavened with the language of the Mogul invader, and the invader has so thoroughly made himself at home in India, and has so successfully maintained the claim of his composite dialect to express the progress and intelligence of the country, that all classes aspire to use it as a sign of good breeding and cultivation.

The language, to quote Dr. Fallon once more, "in which men buy and sell and transact business" is *not* Hindi; it is Urdu. If *man* and *ser* and *chitānk* are Hindi, *kímat* and *nirakh*, *mál*, *saudá*, and *saudágar*, *jins*, *makm*, *bazár*, and *dukán* are Persian. If *háf* is Hindi, *ganj* is Persian. *Sarak*, *bail*, and *gári* are Hindi, but *pul*, *sardí* and *manzil* are Persian. And so it runs through all the scenes of common Indian life; you hear everywhere simple Persian words as frequently as Hindi in the mouths of all classes of the people. I appeal to the experience of all who know well the rural districts of this country for confirmation of this assertion.

We may then safely state that to the higher classes throughout the country, to the Mahomedan rustic, to the townsmen in all districts, Urdu is as familiar and as well known; nay, more familiar, than pure unadulterated Hindi. It remains only to discuss the question as regards the *Hindu* peasant. And it is in this connection that the want of uniformity between the various Hindi dialects requires to be brought out in a stronger light. Hindi is not one, but many. If we follow the advice of our purists, and try to talk and write only pure Hindi, we abandon the possibility of retaining one universally intelligible language and fall back into a chaos of a dozen or more different dialects. In advocating the use of Hindi in preference to Arabicized Urdu, Dr. Fallon's school mean by Hindi those portions of Urdu which are of Indian origin; they mean the dialect which uses *wuh*, *yih*, *iská*, *uská*; which says *honá*, *hotá*, *huá*, *karná*, *kíyá*; that dialect which has been incorporated into Urdu: the Hindi, in short, of Delhi and Muttra. But ten miles from Delhi itself I have heard *wáká* for *uská*, *yáká* for *iská*. If we are to reject such forms as these and use only the Delhi Hindi, we are quite as far from reaching the heads and hearts of the mass of the population as ever. The great Bhojpuri dialect, for instance, is spoken throghout eastern Oudh, Gorackpur, Benares, Shahábád, Sarun and Tirhút, and is more unlike the Delhi Hindi than Dutch is unlike English. I would ask a Delhi or upper Doab rustic to interpret the following from the evidence given in court in a dacoity case by a peasant of Champáran. "*Okerá dwáre gárdhá sunilín, sagare log dháwalan, tán dúí sau jana jamílan, ghare samágelan, sagará dhan, chípá, loṭa, dhán, cháwal sáthi lút lelan, dheri toralan, phin niksalan, áru mushál bhiḡ delan, te bhágalan, t'hom a' P'shádwa chaḡet gelín, t'ekho chor pakaráíl gel.*"

This is pretty simple, especially when written down clearly on paper, but when heard from the mouth of the witness, mumbled and half pronounced and spoken with the rapidity of a steam-engine, it is not so easily caught. It means: "We heard a noise at his house. Every one ran [there]. There two hundred men were collected. They entered the house. They looted all the property, platters, lotás, rice [of three sorts]; *dhán*, [unhusked]; *chávuł*, [husked]; *sáthi* [a species of Bhadai rice]. They broke the granary; then they came out, threw away their torches and fled. Then I and Parshád pursued, and one thief was caught."

Does Dr. Fallon wish us to fall back on this dialect, for instance, with the certainty that by using it we render ourselves unintelligible to one-half of India? or are we to use some other dialect, unintelligible to this half? Or again is each Englishman to use the dialect of the district where he finds himself, and have to learn a new dialect at each change of station?

If in reply I am told that the language meant by Hindi is the dialect of *hai* and *huá*, *kartá* and *kiyá*; and not that of *bhá* and *bháíl*, *karat* and *karalan*,\* nor that of *che* and *chilá*;† nor that of *híndá* and *hoyá*;‡ nor that of *cho*, *chá* and *chi*;§ and that a certain amount of necessary Persian words is allowable, I would ask where are we to draw the line in Hindi between what is classical and what is provincial, and in Urdu between what Arabic words are allowable and what are not?

*Remarks on some ancient Hindu Ruins in the Garhwál Bhátur.*—By Lieutenant AYRTON PULLAN, Assistant Surveyor, Great Trigonometrical Survey.

[Received 6th June, 1867.]

While engaged in surveying a portion of the dense forest that skirts the foot of the Himalayas between Garhwal and Rohilkund, I discovered a very remarkable temple and a number of carved slabs scattered through the jungle. These ruins have hitherto escaped notice, owing to the dense jungle in which they lie hidden. The

\* Bhojpuri.

† Tirhút.

‡ Panjábi.

§ Rájputaná and Harrowti.

admirable preservation in which the temple still is, and the beauty of the carving on it, and the surrounding fragments, have induced me to make sketches of the most remarkable portions. I send herewith zincographs\* from my sketches, trusting that with the following brief account, they may prove interesting to the Asiatic Society.

In January last, while in the Chandipáhár Seváliks and near the site of an ancient but now ruined village called Mandhal, almost six miles east of Hurdwar, I found among the grass the carved figure of a Bull; following up my discovery I came upon a small temple of exquisite carving and design, the figures on the frieze in fine alto-relievo and the whole arrangement of the façade perfect.

Round the temple, which was eight feet in height and six or eight feet square, were scattered a number of carved slabs, a group of wrestlers, Ganesh with his elephant head, and some gods under canopies so very Buddhist, as to remind me of "Sákya Thubhá" on the drawings of the monks of Zauskar and Ladakh.

The temple itself stands on a platform or "chabutará," twenty feet square, and at each side is a trench or drain which was probably intended to carry off the water, and leave the flat square dry for worshippers. Beautifully executed heads terminate the trench at the four corners: on the south a woman's head and bust, at the west a lion, at the north a ram; the east corner is broken and defaced. These heads in form and execution brought to my mind most vividly "the Gargoyles" on the gothic Cathedrals of Europe.

Scattered about were two or three large capitals and shafts of pillars, evidently belonging to a building of far larger dimensions than the small one now standing. The frieze and doorway faces the south; the northern door is much plainer, but I would draw attention to one of the pillars shewing a *stag under a tree* which is identical with the stag and tree on a silver coin found by me two years ago near Betrut in the Saháranpur district, and attributed to the Maharájá *Amodha*; the coin is now in the possession of Bábu Rájendralála Mitra of Calcutta. Inside the temple lies a square carved slab, cracked by a fall, bearing a fine three-headed deity. This three-headed god occurs on most of the slabs throughout the Terai, and is conspicuous on the lingam found near Lál Dháng.

\* These zincographs may be seen in the Library of the Asiatic Society. Ed.



Whether the stag and tree, common alike to temple and coin, gives a clue to the builders; whether it suggests a stream of Hindu civilization driven by persecution into the untrodden forests of the Terai, like "the pilgrim fathers," seeking in the wilderness quiet to worship God after the fashion of their ancestors; or whether it may perhaps go to prove that in time past the deadly fever-smitten Terai was not deadly, but a cultivated country filled with villages and inhabitants;—these points I leave for antiquarians to decide.

About eight miles further east in the Lúni Sot, a narrow stony ravine running down from the Himalayas, I found some more slabs, one with a beautiful female head, and two or three large pillar shafts and cornice-mouldings, similar to those at Mandhal. After a long search I could find nothing further; but an old Brahmin who had a cattle "got" in the ravine, told me that twenty years ago several fine figures, slabs, &c. were carried away to Jayapur and Gwalior by wood-cutters from Central India.

Four miles further east, I came on the ruins or rather indications of a city (the place is now known as Pánduwálá) near the police jungle chauki of Láll Dháng. Here after an hour's search I at length lighted on the object of my visit; I found the ground beneath the tall tiger grass and tangled bamboos covered for a couple of square miles with heaps of small oblong red bricks, interspersed with carved slabs of stone; but the most singular and beautiful relic was the last to reward my search; this was a stone "lingam" of most exquisite work, half buried in the ground, but when excavated, standing three feet high and carved on three sides.

Forty or fifty small chirágs were turned up by my servants, while excavating the "lingam." The people at Láll Dháng told a similar story to the Brahmin at Lúni of figures and slabs that had been carted away to the plains at different times. At Pánduwálá I observed three or four evident indications of foundations of houses, and in one place a half-choked canal of good stone work, which had brought water doubtless to the people of the buried city from the cool hollows of the Bijinagar "Sot." A large stone, six feet in circumference by three in diameter, also lay near the foundation of one of the houses of bygone Pánduwálá. At Mawakot, a Boksar village in the Terai, eighteen miles east of

Pánduwálá, I found some more slabs, some of the three-headed divinity and one bearing a very curious figure. An old Brahmin, a resident of the village, told me that it represented "Jangdeo Kumár." The mailed figure with his armed supporters seemed almost an ancient gothic knight, but the curious tracery of fishes surrounding the warrior, somewhat destroyed the illusion. I found nothing more worth recording during my stay in the Terai, but I came on continued indications of what once had been: here a chipped and broken cornice near a cattle "Got." stuck up on end by the ignorant Paharis as a "Deotá," there a great slab of hewn stone lying alone among a clump of bamboos in the middle of the forest. That these remains extend through the whole length of the Rohilcund and Kumaon Terai, I should think there is little doubt. I was told that at Rámnagar in the Kumaon Terai, there were some very fine slabs and carved stones, but I was unable to make my way there.

My remarks on these interesting relics are of necessity meagre, but I hope that my drawings may induce some of the antiquarians of the Society to throw some light on these ruins in the wilderness. I can find no mention of these ruins in Batten's work on Gurhwál and Kumaon, although that writer mentions the Dwáráháth frieze and carvings in Kumaon. I believe I am the first European who has seen the Mandhal temple, or indeed any of these ruins, as none of the district or forest officers had ever heard of their existence, until I mentioned them.

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*Notes on ancient Remains in the Mainpuri District.—By*  
C. HORNE, Esq. B. C. S.

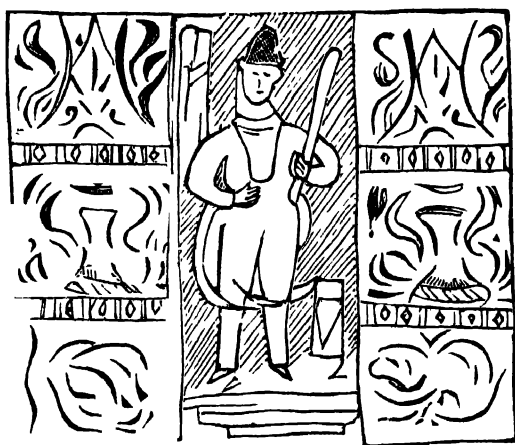
[Received 8th June, 1867.]

*Asauli.*—This large village is within two miles of Mainpuri to the north east and can be best approached by the old cemetery, from which it is perhaps three-fourths of a mile distant.

Crossing an "úsar" plain, and passing through the village of Sikandarpur, you see the village of Asauli picturesquely perched on its mound, which rises some forty feet from the level of the plain. At one end is a large native brick house used by the Rájá of Mainpuri during the mutiny, whilst at the other (the east) are swelling mounds covered with trees. But ere you can reach the said village, you have to go a long way round to avoid the extensive sheets of water which environ it on three sides, and which have been caused by the earth excavated therefrom to raise the mound.

Entering by the east, one at once notices a large heap of stones, &c. on a small mound, and here one naturally looks for the Buddhist temple or "chaitya" which certainly faced the rising sun.

Nor is one disappointed, for amidst the mass stands a stone with a deity thereon carved, now called by the villagers "Gúlpib-Debí." This is represented in the rough sketch given below; it is held by

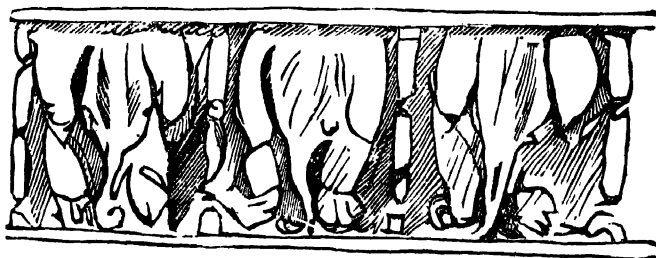


me to represent "Vishnu," the supplanter of Buddh in this instance. This slab may, however, have formed part of the temple, and have been placed to the right or left of the entrance, as in the later Buddhist temple many Hindu deities were admitted. The carving about the figure is very rich and characteristic of the period I would assign to it, viz. circa 500 A. D.

The large squared blocks of kankar forming the original foundation are, many of them, still in situ—and the building will appear to have been of some size and of the usual crucial form. The length of the cross is not easily ascertained. A single cornice block will, however, give some clue to the size of the structure as it measured 34" deep by 20" wide.

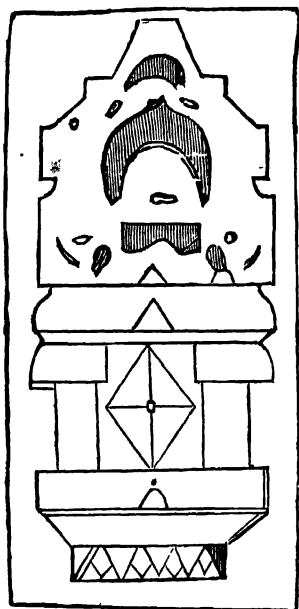


Several heads of Buddh, carved in the conventional style, were lying about; whilst two niche ornaments revealed him sitting in contemplation, and several lintel stones two feet ten inches in length, shewed that the sanctuary had been richly carved. There were remains of sundry cruciform capitals, and of single and double bases for pillars as well as of the pillars themselves, but the most curious piece of carving to be seen there was a long slab of kankar, a basement moulding which I have figured below. It will be observed that it consists



entirely of elephants seen fronting one. It measured eight feet one inch, and in this space there were five elephants. Another portion of the same basement moulding was found in the village, as also that of a frieze of demon faces which may possibly have formed part of another building.

Amongst the ornamental carvings were several settings of "viráj"

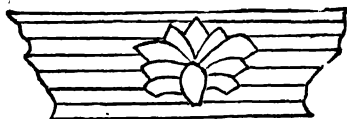


or jewel shewn in the margin ; whilst the over-branching vase does not fail to assert its prominent place.

There were also remains of statues of both male and female figures nearly nude, with elaborate waist-belts ; but these appeared to me to belong to a time when the sensuous Jains were supplanting the Buddhists.

It is very curious to trace on these stones records how the purer faith of S'ákya Muni mingled and became incorporated with and debased by the grosser superstitions of S'íva and Vishṇu—to see how the pure and, so to speak, classical severity of rendering of the human form gave way to the sensuality of engrafted creeds—how S'ákya him-

self became adorned, needed clothing to cover him, instead of that wondrous veil of drapery generally indicated by merely the faintest waist-line or mark across the thigh, and required “*tíká*” marks and tiara, how the forms of his attendant female devotees bent and twisted themselves with their distended busts, and how, in truth, the small spark of light S'ákya had revived died out. Again, wandering about the village, one finds everywhere traces of carvings on blocks of stone built into walls. See below. These much resemble those at Malaun which I have before described.



Some are like the figures at Mathurá and Bhilsa ; whilst I could not find that any Hindu temple had ever taken the place of the original Buddhist or Jain structure, in which, as afore-noted, it is probable that some of the Hindu Pantheon had found a place.

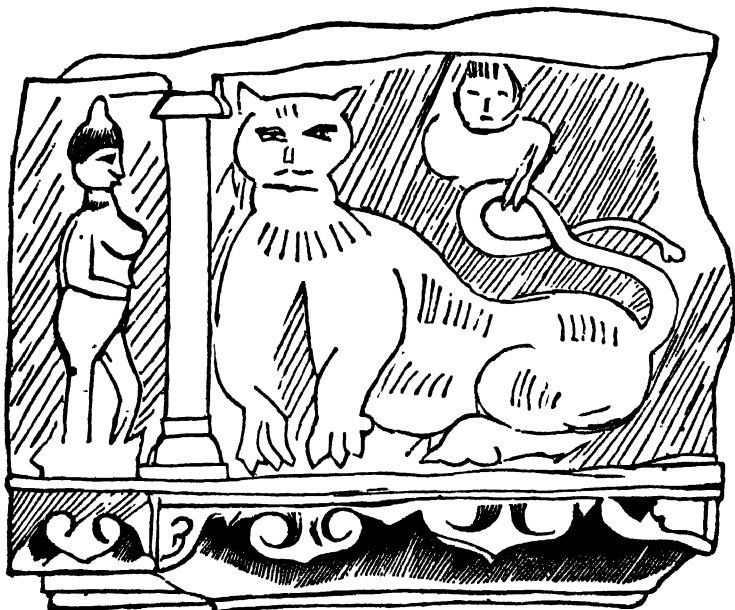
The mound is of great extent, running nearly east and west. It is perhaps half a mile long and of about the same width, and in former times there probably stood a large Vihar or convent on its western end, where it is highest.

Near this were lying six large stones very richly carved and in good preservation. The carvings upon them appeared to be metaphorical representations of the seasons. They are said to have been dug out from near where they are now lying some years since, and the stones (sandstone) appear quite fresh.

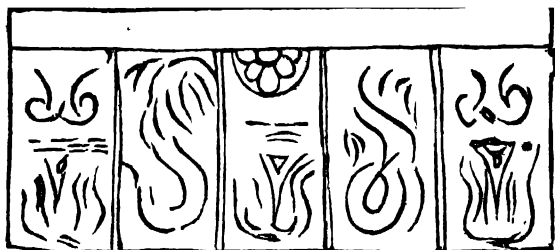
On one, five feet in length, S'ákya is seated on a tortoise. Two devotees kneeling, hand or offer vessels; whilst from his head springs a tree, going off into scrolls in the bends of which are lotus blossoms. On two or three stand little elephants, and on the others there are "chakwá chakwi" or Brahmani ducks billing and cooing, or sitting alone preening their feathers.



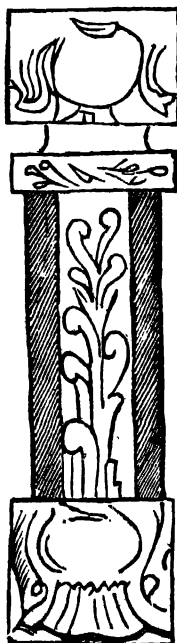
On either side is a panel, much defaced, but upon which "kinnars" or cherubs may yet be seen, and again beyond these on either side are



amatory groups—very Jain—viz. to the left a man playing a tom-tom with a woman holding her hands over his head; to the right a man's hand on his heart vowing devotion, whilst the woman is scorning him. On another large stone, half of which is wanting, is Buddha rested in the middle, the "Navagraha" or nine planets right and left, with the sun and moon on either hand closing the series. This stone is clearly early Hindu.



I append an outline of a portion of another carving which appears allegorical, although I am unable to make it out. I also send an outline of a pilaster found by me at Bichaman on the Grand Trunk Road about six miles distant. Besides being of unusual design, it is pierced with a large round hole, and may possibly have formed part of a railing like that found at Mathurá.



The bricks about the village were not large, and I imagine that in early times, the use of squared kankar blocks for religious edifices was universal in places where stone is not found. The carvings above described were on sandstone which may have been brought from Agra or elsewhere. It is, however, clear from what I have above noted that Asauli is worthy of a visit by any passing Archaeologist.

*Anjani.* About three miles north of Mainpuri in the cross-road leading to Eta lies this village, and the road to it is cut through the base of the large khera or mound which attracts the attention of the Archæologist. To the left (in west) for a very large extent is low marshy land caused by the extensive scooping off of the surface earth for the purpose of raising the mound to the right, on which, in very early times, stood Buddhist or Hindu buildings.

At present the summit is occupied by a small mud fort surrounded by a trench, which I was told was thrown up in Lord Lake's time by the Nawáb of Lucknow, whose authority was acknowledged here.

Close by and still upon the crest of the mound which is of great extent, appears a heap of stones, and this upon closer examination, proves to have been a Buddhist "chaitya" or outlying chapel to a large building.

The basement would appear to be in situ, and stands in the middle of what was once an enclosure of 24 by 18 paces in extent, its longest face being toward the south. The foundation of the enclosure wall has been dug out to the extent of several feet, which reveals the fact that the whole of this part of the mound consists of brickwork laid in mud and the bricks being from 14" to 15"  $\times$  10"  $\times$  2 $\frac{3}{4}$ " in size.

The "chaitya" was constructed of kankar blocks; although some small portions were of Delhi sandstone. The remains, however, scattered through the village, shew that there must once have been a very large building here with columns of considerable diameter; and from their character, I am inclined to assign a date coeval with the decline of Buddhism.

The sheet of illustrations herewith sent, (Plate VII.) shews that the line of *Rakshas'* or demon heads, bears the character of the Buddh Gaya restorations and of many found at Benares and Jaunpur (figured in the Journal) presumed by me to belong to the same period (Fig. 1). The original cruciform capitals (Figs. 2 and 3) and chessboard ("diaper" of Col. Yule) pattern, Fig. 4, betoken great antiquity, whilst the finding in one place of the eight feet of cornice would seem to indicate a larger "Siñhásan" or idol throne for the figure of Buddha than could have been placed in the little "chaitya."



The Hindus would seem to have adopted the said chaitya, for I found three broken "nandies" or bulls and three slabs covered with Krishnas in relief. The carved stone corner of a lintel, Fig. 7, might have belonged to the chapel, and a small clasped hand found in the spot was probably that of one of the "Kinnaras" or angelic cherubs, such as are generally placed around the figure of Buddha. Very many stones were found covered with, what I believe to be, early Hindu cutting, (Fig. 10,) whilst the band of carving Fig. 4 is of a very early type.

I hold therefore that there are good grounds for believing that there was once a Buddhist institution (a Vihāra probably) on the spot with its outlying chapel, which latter was appropriated by the Hindus, for the worship of first, Siva, then Krishna and then—allowed to go to ruin. The drain-stone from the Lingam, shaped out of an old block, is still there projecting over the original step; although the emblem of Siva has departed, and no reverence would seem to be paid to the spot by the present villagers, whose zamindar kindly sent me one of the finest of the carved stones, (Fig. 11,) without any objection.

*Karimganj.* About five and a half miles north of Mainpuri, towards Eta upon the cross road stand the large village of Karimganj. Approaching it from the north, a large mound, a short distance from the road, attracts attention and appears worthy of investigation.

This mound, which is of very great extent, being at base 530 by 330 paces, and which has been formed in ancient times by the heaping of the surface earth brought from a long distance, stands between forty and fifty feet above the level of the country, and upon its crest has been erected in more recent times a mud fort. The level of the general raised surface being taken at ten feet, this fort rises yet thirty feet above that, and presents a very picturesque aspect in its decay. (Plate VI.)

Three sketches and a plan accompany to give an idea of the above. The whole mound is strewn with broken pottery, which is accounted for by the fact that a village used to stand upon it, but has since been removed leaving only these "traces. The kherá" or mound is called by the villagers "Khán Bahádur ká Kherá," and this would appear to have been the name of the petty chief who, subordinate to the Nawáb of Fatehgarh, built the mud fort in the time of Lord Lake.

I examined the mound most carefully; but could not find anything in situ, except a few bricks and these of no unusual size. The fort

is composed, as before stated, of surface (here "saltpetre") earth. Hence the mass of mud is gradually disappearing, being dug out and taken away by the villagers to manure their poppy crops, and thus in the course of time the whole of the upper mound will be levelled. But, although there are no remains "*in situ*," there are plenty around the large well-months and scattered throughout the village, and I subjoin a small sheet of illustrations (Plate VII.) to shew that there must have been in later Buddhist or early Hindu times, building of some pretensions on this spot. Here too I observed for the first time, kankar blocks, with the main lines of the carving sunk deeply in them, and the whole face of the stone covered with fine lime plaster which was admirably moulded.

The patterns thus produced abounded in curved lines, an illustration of which is given in Fig. 3; they resemble those used in the temple at Maláun (distant perhaps twelve miles) and in the "*chaitya*" at Anjani, two or three miles distant.

The whole country appears covered with kheras, upon which many of the villages are built, and my own house here stands on one. So that I hope to discover many more sites of ancient buildings, the remains of a very thickly populated Buddhist state.

*Thakurá.* Leaving Kaíniganj to the west and proceeding due east over the large "*jhíl*" or marsh and some barren sand hills for about  $1\frac{3}{4}$  miles, one comes to Thakurá village, on the farther side of which, under some noble trees are the remains of an early Hindu temple.

These remains, some illustrations of which accompany, (Plate VI.) are curious principally as shewing how the Hindus adopted the Buddhist forms of ornament, and gradually changed them until the ancient style was lost or blended with the more corrupt modern one.

The material used throughout appears to have been block kankar, which is a most intractable stone, being much like a solid sponge, and the people deserve great credit for the way in which they have worked it. It is I believe softer when first dug than it afterwards becomes. The people of this village were very ignorant, and as they had a lurking reverence for the stones I brought none away.

The drawings on the plate may be thus described.

Fig. 1 is the small enclosed shrine, built with squared kankar blocks.

Fig. 2 is a more recent capital.

Fig. 3 is a very singular capital, for a round pillar 11 inches in diameter, in which the ancient cruciform shape is retained.

Fig. 4 is an odd ornament, curious but ineffective. It must have been placed over a window.

Fig. 5 is an extremely handsome ornament of the same kind for placing over a window or niche.

Fig. 6 is a portion of the ornament always found in the projecting faces of old Hindu temples, the form of the capitals is singular, whilst the "viraja" or jewel of Buddha thus set, has become a flower, subsequently often used in ornamentation.

Fig. 7 is a portion of a similar ornament. The form of the capital resembles some seen at the cave temples, and is essentially Buddhist in design.

*Nonairá.* This large and ancient village stands on a very extensive mound which rises from the plain to a height of about 40 feet. It is perhaps  $1\frac{1}{2}$  miles north of the Grand Trunk Road, and about the same distance from the Police Post and Canal Chauki of Dhanahár, and nine miles from Mainpuri.

The name savours of "salt," and we find that until quite recently, from very ancient times, there was a large saltpetre manufactory at this place. Doubtless salt was also formerly made, and hence the name from "nú," salt and "nonairá," salt-maker. Although the mound is so extensive, there is no marsh or "jhíl" around the village. It would seem to have silted up, and the lands are now watered by a branch of the Ganges canal.

On the eastern spur of the mound, I, as usual, found the traces of the foundations of an ancient religious building; whilst to the north stands the fort, in the construction of which have doubtless been employed most of its materials, as remains of heavy cornices were seen cropping out of the foundations.

Enough, however, remained to shew that there had been a small Buddhist "chaitya" with a Jain ceiling. I subjoin a few drawings, (Plate VIII.) and would draw attention to Fig. 1, which represents the boar incarnation of Vishnu, or the "Varáha-avatár." He is accompanied

by the "sakti" or female energy—his wife "Varāhi;" and I observe that Moor in the original edition of his Hindoo Pantheon has a very similar figure on plate 6.

Figure 2 shows the centre boss of the Jain ceiling, whilst Figure 3, gives the details of an architrave of the most ancient type.

Figure 4 is curious, as shewing how the same plan of eaves-stones was adopted over the small windows, cut in imitation of wood, as found by me at Saidpur, Juanpur and Benares.

Figures 5 and 6 are also representations of very rough and ancient carvings.

Figure 7 represent the projecting entablature, of which I found several portions, and which is very finely finished.

Figure 8 shews a portion of the original shrine. It is extremely worn, although the kankar in which it is cut, is of the hardest description.

Figure 9 has also been originally well cut; but the wear of centuries has almost levelled the high relief in which it was executed.

Figure 10 shews a detail which, taken in connection with two pillars found, proves that there was a smaller under shrine.

Figure 11 is another instance of bricks carved with a tool.

I was not able to find any large square bricks, commonly called "Buddhist," but many occurred of an unusual form, and the Kārindā of Rājā Prithvi Sing, the zamindar of the village has kindly sent me one, which is at the service of the Asiatic Society, and which measures  $12\frac{3}{4}'' \times 9'' \times 4''$ . The ornament represented on Figure 11 was cut from such a brick, but the art of cutting and shaping bricks would seem to have been now entirely lost in the village.

In spite of their thickness, these bricks are beautifully burnt, and each one is marked on one side. The lines with which they are marked appear to have been made with the three fingers of the right hand, having been very carefully drawn across the brick when first moulded. Amongst more modern (yet ancient) bricks I have often seen the mark, made with the finger. This I believe to have been as a charm, and to have roughly represented the trident. This mark also occurs as a mason's mark on marble at Agra, in buildings of the time of Shāh Jahān and Akbar.

I am not aware of similarly ornamental bricks having been else-

where noticed, or described; although I may here add that I found one carved into a capital at Sarnáth, which may be seen by the curious at the Museum, Queen's College, Benares.

*Máiláún.* When driving on the Grand Trunk Road on my way to Eta, and 13 miles east from that place, I unexpectedly came upon an old temple, and as I have not met with any account of the same, I made a few notes and drawings which may perhaps prove of interest to some, and which I therefore annex. The first thing which attracted my notice, was the size and regularity of the kankar blocks with which the temple had been built.

They varied from 3' 6" to 4'  $\times$  7"  $\times$  9", and appear to have been freely used by the officers of the Grand Trunk Road for bridge building, for many miles of road. Jaswant Singh, the old Thákur zamindar of the place, told me that a certain "Conolly Sahib" had taken the road right through the temple, entirely clearing away the southern arm of the cross, in which ancient form, the erection had been constructed, and used Government vans at night to transport blocks of kankar, carved and plain, for his works; whilst the "oldest inhabitants" who professed to have remembered the occurrence, added—"The kaidís (prisoners) backs were broken by their weight," and a third put in, "Nay, but they were killed outright!"

This is merely mentioned, to shew the need of some officer to see to the preservation of old ruins; for the zamindar offered me as many stones as I might require, and did not appear to mind their removal.

But to resume my account. The only portion of the original foundation that I could find laid bare, was built with large bricks 14" or 15"  $\times$  8"  $\times$  2½" and was 5½" in thickness, with a buttress extending 9 feet. The facing of the superstructure, was originally composed of the large blocks of kunkur formerly alluded to, and very little other stone appears to have been used.

In Figure, No. 14, a specimen of the basement moulding is given. This is about 1 foot in depth, and is of the most ancient type. Sundry traces of Hindu restoration of an ancient Buddhist chaitya are apparent; amongst others, a large lintel stone (of Agra (?) sandstone) with the peculiar frog-like crushed figures at either end, so often seen in modern Hindu temples at Benares and elsewhere. This stone

is fully 6 feet in length. There were lying about, both in the temple and near a bridge three miles nearer Etá, by the road side, many cut blocks of kankar.

One of them, figured as No. 10, bore traces of great antiquity, and reminded me of some faces similarly arranged, which I had drawn at Benares: the type is a universal one.

Many fragments of cornice were also lying there, all indicating a large building. Two of these are shewn drawn to scale in Figures 3 and 4. Ornamental details, figures 2 and 12 indicate the date of the work, the former being very bold and effective; whilst the latter, in spite of the rough grain of the kankar, looks very rich.

Moulding, No. 13 is ornamented with the old denticulated pattern, and has a good effect.

Figure 11, shews two tigers, more modern in their design.

From the above it will be seen that the details of ornamentation were very rich, in spite of the uncompromising nature of the material, viz. porous block kankar.

The temple was built upon a slight mound raised with earth, dug from the neighbouring marsh, now nearly filled up by the annually drifting sand of this part of the country. The temple covered a space of about 75 feet square.

The form would appear to have been oblong. I was able to recover two of the pillars, which had been originally used. It will be seen by figures 8 and 9, that they were of a very simple and early style.

The base figures in both and the central portion in each is eight-sided. The upper recessed portion in Figure 9 has, however, only six sides. These pillars may have formed part of the same building; for we often find different patterns employed in one edifice.

Figure 7, represents an eaves-stone cut in imitation of wood work. It probably covered some small door or upper light, and, as before remarked, resembles those found at Jáunpur (Pair Daruba and Atala mosque) and Rajghat, Benares. The figure of a sitting Buddha is still on the spot to point out who were the founders, although there are also several Hindu deities present in effigy on sundry slabs of stone, to attest the subsequent appropriation.

Around the niches once occupied by figures of Buddha are handsome

ornaments one of which, (32 inches by 24 inches) has been figured by me as No. 15. There were many others of the same character. We now come to the roof. Of the central slab of this Buddhist (or as Fergusson would call it "Jain") ceiling, I was fortunate enough to find three portions, one of which has been figured as No. 5; it is drawn to scale, from which it will be perceived that the central rose lotus blossom must have been 5' 4" in diameter. This would give a central chamber vault of at least 11 feet, or with the cornice 12 feet. The massiveness of the long slabs of *block kankar*, must have been very great; but they were not sufficiently strong to bear the weight of a large pipal tree, which now stands upon this spot, and which doubtless helped much to cause the ruin.

Arrived at the exterior of the roof, we find a strange pinnacle, of a form new to me, one in which the form of the vase is not abandoned, but very well adapted. Vide figure 1.

There were also built into the walls around, the remains of three kalasas, each of 3 feet diameter, which, doubtless, at a subsequent period, capped portions of the edifice. I also observed the fragment of a very singular capital (figure not numbered) which would seem to have been used in the building. An emblem of S'iva has been erected in the centre of a wretched enclosure on the site, and the said enclosure is generally kept clean; but except by the women, much sanctity does not seem to obtain for the place. It is, however, the scene of many a festive "mela" or fair, held at regular intervals, and for the convenience of visitors at which, the kankar blocks have been much scattered and rebuilt into small walls. The temple was undoubtedly of Buddhist origin, and belonged probably to the fifth or sixth century after Christ. Of course, it was impossible to find any mason marks, as these could not be well cut on kankar blocks. There was no inscription that I could discover, whilst my search for coins in the village produced nothing.

These notes may prove the more valuable, as it is probable that in a short time not a trace will remain of this ancient ruin. •

*Karauli*.—At the suggestion of General Cunningham, I drove over to Karauli, which is about 11 miles north of Mainpuri, and upon the Grand Trunk Road from Allahabad to Delhi, being 240 miles from the latter place.

There is a magnificent grove, at the road side, of gigantic tamarind and other trees, under which are scattered some Muhammadan tombs, and there are traces everywhere of this town having once flourished under the Musalman emperors, of whose coins I obtained three or four, as well as two of the nail-headed character. These latter abound in these parts. A thorough search through the town shewed no traces of very ancient buildings in situ, although the old fort mound, now being levelled and converted into a "ganj" or market place, may have been the site of one. I, however, marked about 30 stones, i. e. block kankar and sandstone, which had once formed parts of a Buddhist erection, and all of which appeared to me to have been brought from Malaún about eight miles distant. I have figured some of these. Of No. 1, I found two portions; the rest of the cornice being at Malaún, and a band of the same pattern adorns one of the faces of the great tope at Sárnáth, and has been figured in the "*Researches*" of the Asiatic Society by General Cunningham.

Figure 2 is commonly to be found carved at the Atala mosque, Jaunpur, and on very early capitals.

The forms shewn in Figures 4, 5, 6 and 7 indicate great antiquity. There are similar ones at Malaún and at many other places. The basement moulding Fig. 8 is very bold, massive and effective, and also of a very early date.

Figure 9 is very singular; but there may be doubts as to its age.

Cornice, Figure 3, needs no special remark.

Many of these stones were found built into the gateway of a new sarái; some were seen near the Old Fort or walls; whilst others were used to form the mouths of wells.

Fragments of three kalasas, of a similar size as those found at Malaún, were also discovered; so that the conclusion I arrived at was, that no building of any note in Buddhist times, had existed in Karauli, but that these remains had been plundered from Malaún, which would seem to have been used as a quarry for many years past. I find this district to be dotted over with high mounds of great antiquity, many of which produce stones as herein illustrated; I hope to examine more of them.

This fact, however, shews one that caution must be exercised in statements as to whence stones have been taken; for there may have



been many small shrines or "chaityas" in connection with monasteries on mounds, which latter may have been built of bricks, which said bricks, which is commonly the case here, have been annexed and used by the surrounding villages.

I can, I am sorry to say, obtain no written notice of these mounds, and they are far beyond the range of oral tradition. A collection of the best of these carved stones might be made *here* by Government at a very little expense; but no one in these parts appears interested in the subject.

*Jusrāu*, visited February 13th, 1866. About two miles west of Anjani village, described in a former paper, lies the village of *Jusrāu*. It forms part of the titular Rájá of Mainpuri's zamindári or estate, and has, I have little doubt, been plundered of its best archæological remains in the shape of pillars and capitals by former residents of Mainpuri, from which it is scarcely three miles distant. The last attempt would, however, seem to have secured immunity for the future from these spoliations.

The "oldest inhabitant," a grey-haired Brahman, informed me gravely, pointing as he spoke to a large block of kankar which had once formed part of the ancient Buddhist shrine at this place, that the Rájá had sent for this to be used in building; that he had laden it on a two-bullock cart; but that the cart had broken down and the bullocks been drowned whilst crossing the river Isan, not very distant, in the sacrilegious attempt to remove it. He added that the fresh cart and bullocks then sent by the Rájá brought it back *with ease*, and restored it to the spot where I then saw it. So alarmed are the villagers, that they will not use the smallest, plainest stone for any purpose, and in proof of their sincerity, they shewed me their great need of a good well, saying that they were too poor to burn bricks for it, yet they dared not use the blocks lying about in profusion. And this was the more curious, as the remains about to be described, are thoroughly Buddhist, and not at all Brahminical in their character, whereas the village is a Brahman one.

The cart track leaves the high road from Mainpuri to Etá, shortly after the 4th mile, and crosses a sandy expanse, now covered with crops of barley, &c. until it terminates in the village. To the east of there are remains of what had been formerly two village

Buddhist shrines, and these were all the buildings to be traced. These are both 50 feet by 30 feet, measured outside, and Plans Nos. 1 and 2 sufficiently explain them. Each has a raised platform 19 by 12 feet, built of well-cut kankar blocks without cement, and quite plain. These must originally have risen from 5 to 6 feet, from the terrace in which they stand; for even now in one place the finished upper work is of that height, whilst in others, rubbish has accumulated. On these raised platforms were probably originally built open chaityas as at Bakariyá Kund. The remains of kalasas or dome caps, of 5 feet in diameter, such as could crown a "Vimána" of 30 or 40 feet in height, evidence large buildings; whilst the finding of several projecting face ornaments enabled me at once to state with certainty the original form of the building. See Figures 4, 5 and 9.

The present residents of the village call the ruins by the name of Jagat Deví's temple, and they tell me that at the Holi festival, a great "mela" or fair is held here, when offerings of ghi and rice are made to the Deví, who is neither more nor less than our old friend "S'ákya Muni" or Buddha. The local name merely means "The deity of the locality."

Buddha is to be found sitting in every niche in the sculpture, and there is, besides, the two small figures, one of which does duty for Jagat Deví, (Figure 5,) and another very well carved, some 4 feet in height, of which I give a rough representation, Figure 8. Nearly all the Buddhist ruins about here, would seem to belong to the time of the decay of the purer faith, and these are no exceptions; for we find the ornaments of the projecting faces to have been the same at Anjani, Karianganj, Karauli and Malaún. Vide Figures 4 and 5.

- Here I saw for the first time on kankar, what I believe to be a kind of mason's mark: Figure 11. The carving of the large Buddha is very well executed; but the head has been knocked off and replaced minus part of the neck; and the two upper groups of "Kinnaras," or cherubs, are altogether broken away. The two tigers under the lotus, are the same as those I saw at Malaún; the animals are something between a pig and a bear. The forms of these I saw in Behar, and also on a stone in Benares opposite to the Golden Temple.

To the right at base is the figure, supposed by Mr. Sherring and me to be "Surya," the sun, and figured amongst the remains from Bhitári in the Society's Journal, Vol. XXXIV. Part I. plate xvii. The lotus or glory around the head, is finely cut in relief, as is also the canopy. There were no traces of large bricks, but all seems to have been built of kankar blocks. In all this village, I saw no trace of the worship of S'iva, and truly, all fell down before, although many openly laughed at this their *Unknown goddess*, "Jagat Deví," the fear of whom was moreover shewn by their not daring to touch a stone of her former temple.

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*Additional note on Karauli.*—Since recording the foregoing notes, I have had several opportunities of examining ancient carved stones at Karauli. Chaudhari Luchhman Siñh is constructing a tank in steps, the entire facing of which, consisting of squared kankar blocks, is composed of the remains of some very large and handsome Buddhist buildings, which, contrary to the opinion heretofore expressed by me, existed on the spot.

These blocks, in number several thousands, were found when leveling the mound or "khera" for the purpose of laying out a large market. I subjoin a plate (x) of some of the more remarkable, which need little explanation. There were besides, large and handsome mouldings and specimens of nearly all the carved ornamental bands in use in this class of buildings. As usual, however, there had been a reconstruction; for I found two huge blocks of kankar with the tigers "couchant" placed one on either side of the doorway; whilst originally they had been joined and formed the basement for a large figure of Buddha.

The drawing No. 1, Plate X., represents what was probably at the back of the shrine, and resembles other portions found at Noner and elsewhere. It is very complete and curious. No one can say what may have been built into the tank-facing, but this is one of many instances in which valuable carvings have been lost. A few slabs were secured by me for a local museum, should such ever be established in Mainpuri.

At the village of Rasemá, where is a large and ancient khera, I saw remains of a small building, similar to some of those described

in these notes. This village is about two miles south of Karauli, and I here secured a curious vase-shaped pinnacle which well denoted the period of its construction.

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#### LITERARY INTELLIGENCE.

A very useful handy-book on the Hindu law of adoption has just been published under the patronage of Honorable Prasanna Kumār Tagore, C. S. I. It is entitled the *Dattaka-Siromani*, and contains the substance of all the leading treatises on the subject, including the *Dattaka-mimāṃsa*, the *Dattaka-chandrikā*, the *D. nirṇaya*, the *D. Darpaṇa*, the *D. Dīdhiti*, the *D. Kaumudī*, the *Dattaka Siddhānta manjarī*, as also of an apocryphal treatise named the *Dattaka Tilaka*. The work has been compiled with great care and judgment by Professor Bharata-chandra S'iromani of the Sanskrit College of Calcutta, who has also supplied, at the end of each chapter, an excellent summary of its subject.

Anglo-Pāli literature has received an important accession in an English translation of the Attanagalluvansa of Ceylon, by James d'Alwis. Though professedly a history of the Temple or vihāra of Attanagalla, it contains the chronicles of King Sangabodhi, who reigned in the middle of the 3rd century A. D. In an elaborate preface the translator has discussed a number of interesting questions regarding the Singhalese Chronicles of the Mahāvansa and the Dīpawansa, and of translations of particular passages in them by Turnour and others.

The Librarian of the Sanskrit College of Calcutta, Pandita Jagan-mohan Tarkālankāra, has brought out an edition of the play of *Chanda Kausika*, of Khemísvara. The author flourished in the court of Mahipāla Deva of Gour, and his work therefore is about 900 years old. By a curious mistake the editor, confounding an epithet with a proper name, says in his preface that the work was written for the entertainment of a king of the name of Kārtika who flourished between four hundred and a thousand years ago. The subject of the book is the preëminence of truthfulness as illustrated by the story of Viśvāmitra and king Harischandra. The Tāmil version of this

work is well known under the name of *Arichandra*, of which an excellent English translation was, a short time ago, published in England by Mr. Matukumāra Svāmi of the Ceylon Legislative Council.

The same editor has also published a new and very carefully revised edition of the *Venisañhāra* of Bhaṭṭa Nārāyaṇa, with a new commentary.

The learned professor Jayanārāyaṇa Tarkālañkāra, to whom Sanskrit scholars are indebted for several excellent commentaries on ancient Sanskrit authors, has lately presented to the public a very useful little digest, named *Pudārtha-tattvasāra*, containing an epitome of the Philosophy of Kapila and Kanāda. The book will prove a great help to the students of philosophy in the Sanskrit colleges of Calcutta and Benares.

An original treatise on the mode of performing the ceremony of weighing one-self against gold, silver and other articles intended for presentation to Brahmins, *Tūlādāna-paddhati*, and a new grammar of the Sanskrit language (*Āsubodham Vyākaranam*), have been brought out by the indefatigable Professor Tārānātha Tarkavāchaspatī of the Sanskrit College. The former will prove useful to those who have especial faith in, and the means to perform, the interesting ceremony of which it treats, but we doubt very much if the latter is likely to supersede the excellent compendium of Varadarāja, the *Laghu Kaumudī*.

To the Persian scholar, we have to recommend a small volume containing two small treatises on Metre and Rhyme, the '*Arūz*' of Saifi, and the *Kāfiyah* of Jāmi, very carefully edited by the learned Shemitist, Professor H. Blochmann.

In three old letters found in the archives of the Asiatic Society, the late Colonel Wilford announced to Mr. Edward Colebrooke, the discovery of certain Sanskrit MSS. on geography, of which no notice has since been met with, and which seem not to be known to Sanskrit scholars. The works named are, 1, *Bhaviṣhya Purāṇa* of 60,000 slokas. The *Purāṇa* of that name, according to the *Vishṇu Purāṇa*, should contain only 14,000 slokas. In the commentary on the second work on our list Jayasinha, "who often speaks or is made to speak in the first person, says that he had in vain sent people all over India to procure it; he ascertained that it was not to be found, and supposed it no longer existed; however near Allahabad he heard that it was in *Trina guru Desa* or Tibet, in the possession of Jnāni guru, and that he got a copy from

him." 2nd *Dharma Kosha*, of 700,000 s'lokas, compiled by order of Jayasinha Rájá of Jayapur, who is said to have "sent the author to perambulate the Gangetic provinces. He was furnished with a *Machiles-wara* or compass, and a water clock which as he advanced shewed the coss and its parts." 3rd, *Bhrigu Sañhitá*, "between 40 and 50,000 s'lokas, all on geography." 4th, *Garga Sañhitá*, "certainly about 2½ lakhs of s'lokas." 5th, *Mádhavi Kosha*, "entirely on geography. It consists of 10,000 leaves or above nine lakhs of s'lokas. It requires three men, or at least two very strong ones, to carry it. It is divided into 56 books describing the Chhapan Desa of India." 6th, *Ishṭa Purāṇa*, "compiled by order of Māna Sing for the illustration of the geography of the Purāṇas—about 2½ lacks of s'lokas." 7th, *Ahabala Sañhitá*, "of 56 Sections relating to the 56 grand divisions of India." 8th, *Sūta sañhitá*. 9th, *Parásara Sañhitá*, "both on geography." Wilford possessed MSS. of most of these, and it would be of interest if they could now be traced.

• The following are extracts from three letters lately received from Professor Holmboe of Christiania, giving the results of his recent researches into Indo-Scandinavian antiquities. The first is an abstract of a memoir on some figures sculptured on a rock in Scandinavia, which will be found interesting to Indian Archæologists:—

"Depuis un temps immémorial on voit sur les rocs près de la mer aux côtes de Suède et de Norvège un grand nombre de figures sculptées, représentant des navires, des roues, des voitures, des hommes armés, des chevaux, des cavaliers, des souliers, &c. Elles se trouvent ordinairement groupées ensemble, ce qui a motivé quelques archéologues à les prendre pour des tableaux exécutés en mémoire de batailles, particulièrement par mer. Mais il est constaté, que les figures, qui forment une groupe, ne sont pas contemporaines, mais fabriquées à différentes époques. Le navire ou bateau sont des symboles ordinaires de la métempsychose en Orient; et les mêmes symboles se trouvent parfois sur des pierres sépulcrales dans le Nord. M. H. suppose donc que ces figures sculptées sur les rocs y sont placées en mémoire de personnes décédées, et que le choix des figures dépend ou du gont des parents survivants, ou de la position, sociale du défunt, ou de quelque événement important de sa vie. Quant aux autres figures, les souliers, les voitures, les chevaux &c. l'auteur renvoie le lecteur à la croyance des

payens, que le défunt devait passer par des chemins obstrués par des épines et d'autres difficultés, à cause desquelles on avait dans le Nord la coutume de lier des souliers sous les plantes des pieds des morts. On peut donc envisager les souliers, les chevaux et les voitures comme symboles de leur voyage à Valhal. Enfin M. H. émet l'opinion que les petites voitures de bronze qu'on a découvertes en Allemagne et en Suède, une fois du moins dans un tertre sépulcrale, ont servi à des cérémonies funéraires emblématiques symbolisant le départ de la vie terrestre. Les mémoires sont illustrés d'une planche et de beaucoup de tailles en bois."

The Professor gives the following brief notice of an essay of his on the sacrifice of the Horse among the Scandinavians :—

" On lit dans les anciennes Sagas ou histoires de la Norvège que plusieurs hommes consacraient des chevaux au dieu Frey, et au commencement de chaque année on sacrifiait des chevaux et en mangeait la viande. Mais dans une Saga Islandaise, dite Vatsdælasaga, il est raconté, qu'un homme nommé Hrafnkel avait un Freyfax, c. à d. un cheval consacré à Frey, et qu'il avait défendu chacun d'y monter sous peine de mort. Néanmoins un de ses serfs le monta, et fut puni de mort. L'auteur compare cet événement aux effets de la consécration des chevaux chez les anciens Indiens et chez les Kalmuks et les Mongoles actuels. Chez ces peuples il était et est défendu sous des sévères peines de monter les chevaux consacrés."

The next two memoirs of his noticed by the Professor are on certain gold rings on which the ancient Scandinavians took oaths. In the first of these—

" l'auteur attire l'attention aux anneaux, sur lesquels les Scandinaves aux temps du paganisme portaient la main en prêtant serment. Plusieurs de ces anneaux ont été trouvés dans la terre et sont conservés dans les musées du Nord. Ils sont faits d'une barre d'or, courbée en forme d'un anneau oval dont les bouts, qui sont un peu plus larges que la partie intermédiaire, ne se touchant pas, mais laissant une petite ouverture entre eux. Pour prouver, que la manière susdite de prêter serment tire son origine de l'Orient, M. H. donne sur la 1<sup>re</sup> planche les dessins de 4 anneaux, un de Norvège, un de l'Angleterre, un de Bretagne, et un de Persépolis. Les trois premiers sont d'or, le quatrième se trouve parmi les sculptures de Persépolis ; le dernier ressemble

tout à fait celui de Bretagne, où on voit dans la grande procession sacrificale des hommes portant en mains levées de tels anneaux. Puisque les sacrifices et la juridiction étaient ordinairement réunis dans les grandes assemblées des peuples payens, les anneaux à serment défendent leur place dans la procession sacrificale. A la 1re. pl. on voit aussi le dessin d'une monnaie celtique, dont l'avvers présente un homme portant en main un anneau de la forme susdite (symbole de la juridiction), et sur le revers un animal et un couteau dessous (symbole du sacrifice). L'auteur émet ensuite l'opinion, que les sculptures Sassanides en Perse où on voit deux personnes portant couronne, dont l'une présente un anneau et l'autre pose sa main là-dessus, représentant le chef des Mages, le grand-mobed, qui reçoit le serment du roi, qui vient de monter sur le throne. Les planches 2, 3 et 4 donnent les dessins de trois des sculptures sus-nommées. A la fin l'auteur donne une liste des poids de 37 anneaux d'or à serment, pour mettre les lecteurs en état de juger, si les fabricants, comme quelques archéologues ont pensé, eurent eu le dessein de leur donner un certain poids correspondant avec les poids convenus ou non; l'auteur en doute.

“ Dans le second mémoire M. H. défend son interprétation des sculptures Sassanides contre un savant Danois, M. Muller, qui pense, que le symbole du serment ne consiste pas dans l'anneau, mais dans le poing que le roi tient devant la bouche (v. pl. 1 et 2 de M. H.). L'auteur objecte contre cette opinion que sur plusieurs sculptures on voit des personnes avec le poing devant la bouche se trouvant derrière les personnages principaux et même tournant le dos envers eux.

The following is the substance of a paper by the learned Professor on the numbers 108 and 13 :—

Chez les Indiens, aussi bien que chez les Bouddhistes autre part, le nombre 108 a depuis des temps immémoriaux obtenu le crédit de posséder un pouvoir magique, et son emploi est très répandu où il est question de cérémonies religieuses. Leur Roudrākshas ou chapelets contiennent partout 108 globules ou corails. Déjà au 3me siècle avant notre ère le puissant monarque Asoka fit reciter 108 prières à la consécration d'un Tope, et environ 100 ans plus tard le roi Dhutthagamani de Ceylan fit employer plusieurs articles au nombre de 108, lorsque le grand Tope, Mahathupa, fut bâti. Plusieurs temples de l'Inde contiennent 108 Lingas ou symboles du dieu



Çiva. La veuve du Raja Tilouka Chandra fit bâtir 108 temples pour le culte de Çiva, et on y plaça 108 Lingas et 108 images du boeuf sacré. Dans quelques réglemens il est prescrit de se promener 108 fois autour de l'image des dieux. L'auteur émet la conjecture que l'influence du même nombre s'est fait sentir dans l'emploi du nombre 540, qui selon le rapport de l'ancienne Edda fut le nombre des portes de Valhal, la demeure d'Odin, le suprême dieu des Scandinaves; car  $540 = 5 \times 108$ , et le nombre 5 a aussi joui de la renommée d'un nombre merveilleux. Si nous résolvons le nombre 108 dans ses éléments, nous aurons  $2 \times 2 \times 3 \times 3 \times 3$ , et la somme de ces éléments est 13. Or le nombre 108 une fois reconnu sacré, la somme de ces éléments ne doit pas avoir trouvé difficile d'acquiescer le même crédit. Les Bouddhistes de Népal enseignent, qu'il y a 13 bhuwanas ou demeures après la mort pour les vrais croyants, et par conséquent ils construisent sur leurs bâtimens sacrés des tours, ayant 13 étages. Dans une légende Tibétaine on trouve la description d'une contrée ravissante, où il croissaient trois fois treize (sic) sortes de fleurs, et 108 sortes de plantes odoriférantes, et qui étaient arrosées par 108 sources. Les devins de la Chine se servent d'une baguette divinateuse divisée en 13 paliers.

Une confiance égale dans le nombre 13 se découvre en Scandinavie dans l'emploi de 13 pierres placées debout formant des cercles, qui marquent les places où des reliques de personnes d'importance ont été enterrées. Quoique ce nombre n'est pas l'ordinaire, il est cependant remarquable qu'on le trouve assez souvent. L'auteur cite entre autres par ex. une paroisse en Norvège, où il restent encore trois tels cercles de 13 pierres chacun.

Concernant la raison de choisir le nombre 108 l'auteur propose diverses hypothèses, parmi lesquelles il trouve celle la plus vraisemblable que le choix est dérivé de quelques idées astrologiques ou astronomiques. L'ancien astronome Varāha ayant calculé la précession du point équinoxial du printemps, crut avoir trouvé, qu'il procède pendant 3,000 ans vers l'Orient, parcourant  $27^\circ$  du zodiaque, retourne ensuite vers l'Occident, passant  $54^\circ$  du même, et enfin retourne vers le point de départ par  $27^\circ$ , ayant fait en tout un passage de  $108^\circ$ .

La dérivation du nombre des portes de Valhal, la demeure du dieu suprême des Scandinaves, d'un nombre sacré ( $5 \times 108$ ) a son

analogue dans la dérivation du nombre des portes de la demeure du dieu suprême des Kalmouques et des Mongoles, dont le nombre 169 est  $= 13 \times 13$ .

The following is the substance of a very interesting memoir affording curious traces of the worship of Ś'iva in Europe in former times :—

Pour se fournir de matériaux à une comparaison entre les traces de Çivaïsme en Europe (hors la Grèce et l'Italie) et les idées Indiennes sur Çiva ou Rudra, l'auteur donne d'abord un court aperçu des qualités de ce dieu. Comme point de départ pour la comparaison il cite un mémoire de M. Ganjal, sur une idole Gauloise appelée Ruth (inséré dans les Mémoires de la Société Royale des Antiquaires de France T. IX p. 61 fig. v.) dans lequel il prouve que les deux anciennes villes Rode (dite Ruthero par les Romains) et Rouen (dite Rotomagus) dérivent leurs noms d'une idole nommée Ruth ou Roth qui avait été adorée par les habitants des villes et des environs, et dans le culte de laquelle les débauches jouaient le rôle prédominant. M. Ganjal tire de là la conclusion que Ruth fut la même divinité que Roudra ou Çiva des Indiens.

M. Holmboe donne ensuite une liste de noms propres de villes et d'autres places en Europe, qui éveillent l'idée d'une dérivation de Roudra, p. e. Rhoden, Rodenacher, Rodenberg, Rodenthin, Rottenburg, Rottenfels, Rhode, Ruhte, Ratheborg &c. en Allemagne; et Ratland, Ruthwel, Ruthin en Angleterre; Rot, Rotholet, Rotnoe en Norvège. Comme dans l'Inde Rudra, à la tête des Maroutes (les vents), est la personification de l'ouragan, ainsi en Europe l'ouragan est personifié par un chasseur farouche (en Hannover appelé Rodo) courant dans l'air, suivi d'un grand cortège. En Norvège et en Suède on a trouvé un nombre de Lingas (symbole ordinaire de Çiva), une fois debout sur un tumulus, une fois dans la chambre sépulcrale d'un autre tumulus, et plusieurs fois autre part. Ils sont fabriqués de marbre ou d'une autre pierre blanchâtre. Le musée de Bergen conserve quatre de ces pièces (voyez les tailles en bois aux pages 24, 25, et 26). Dans une ancienne loi ecclésiastique de Norvège on rencontre une expression, qui jusqu'ici n'a pas été comprise, c'est le mot *Rot*, qui se trouve dans une énumération d'articles payens que la loi défend d'avoir dans les maisons, comme sorcier, idole, &c. L'auteur suppose que *Rot*

a été le nom du linga, emprunté de Roudra. Il cite d'une ancienne rédaction de l'histoire du roi Saint Olaf, qui introduisit le Christianisme en Norvège, un récit d'une famille payenne demeurant dans la province Nordland, qui adorait le linga d'un cheval, qu'on avait tué, mais dont on avait conservé le veretrum. Les soirs cette pièce passait de main en main non seulement parmi les personnes de la famille, mais encore parmi les hôtes qui pussent être présents, chacun récitait un verset en délivrant l'idole à une autre. L'auteur pense que c'est la forme du linga qui a été imitée par quelques urnes sépulcrales, qui ont été découvertes dans les celles de plusieurs tumuli, car elles sont cylindriques et arrondies au fond, (voyez p. 33, où une de Norvège, une d'Angleterre et une de l'Inde sont dessinées). Plusieurs de ces urnes sont ornées de figures émoulées en forme d'ovales. Le musée de l'Université de Christiania en possède quatre ornées respectives de 13, de 39 ( $3 \times 13$ ), de 14 ( $2 \times 7$ ) et de 21 ( $3 \times 7$ ) ovales, or les nombres sacrés de 13 et de 7 entraient dans tous ces nombres,—preuve qu'on les a destinés à un usage religieux, et que les ovales peut-être aussi désignent les œufs, étant symboles de métempsychose;—une doctrine, dont on trouve aussi des traces en Scandinavie. La même idée paraît être symbolisée par les pierres en forme d'œufs, dont on a trouvé des exemplaires aussi bien dans les celles de topes de l'Afghanistan, que dans celles des tumuli de Scandinavie. M. H. renvoie ensuite à un mémoire, qu'il publia en 1859 sur le type de plusieurs bractées d'or, dont les musées du Nord conservent un nombre considérable, deterrés parfois de tumuli payens. Il y a démontré que le type représente Çiva sur le dos du bœuf sacré (Nandi). Preuves, que le culte Indien du bœuf a pénétré dans la Scandinavie sont des légendes de vaches sacrées, qu'adoraient un roi de Norvège nommé Augvald et un roi de Suède, appelé Eustein Beli. Augvald étant mort, ces reliques furent déposés dans un tumulus, et sa vache dans un autre à côté de celui du roi; et en Danemark on a au milieu d'un tumulus trouvé le squelette d'un bœuf. Un nombre si considérable de traces du Çivaisme prouve évidemment, que le culte de Çiva ou Roudra a été très répandu en Europe au temps du paganisme.

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The plates attached to this number refer to Dr. A. Verchère's paper in this and previous numbers of the **Journal**.

Plates referred to in Mr. Blanford's Contributions to Indian Malacology will be issued with the next number of the **Journal**.



# JOURNAL OF THE ASIATIC SOCIETY.

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## PART II.—PHYSICAL SCIENCE.

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No. I.—1867.  
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EXPERIMENTAL INVESTIGATIONS *connected with the supply of WATER from the Hooghly to CALCUTTA, Part II, being Supplementary Observations ; by DAVID WALDIE, Esq. F. C. S. &c.*

[Received 28th September, 1866.]

In the preceding remarks I have directed attention to the discrepancies between my own results as to the quantity of organic matter by weight in the Hooghly water and those given in Dr. Macnamara's Report, and I have also made some pointed observations on the very doubtful accuracy and unsatisfactory nature of the results generally given by chemists respecting organic matter in waters, except some of the most recent. For though I have found that the process detailed in the previous part of my paper is older than I then supposed, having been recommended by Mr. Dugald Campbell in 1856 as suggested by Dr. Clark,\* and that an analogous plan was given by Abel and Bloxam in 1854,† though imperfect, yet these plans seem either to have been little known, or neglected, or imperfectly carried out. Some analysts indeed of later date do not even attempt to estimate the amount of organic matter at all, apparently despairing of reliable results. But the process given, I believe, yields the most trustworthy results hitherto obtainable, if properly performed.

\* Journ. Chem. Soc. Vol. IX. 1856, p. 51.

† Handbook of Chemistry, 1854.

But if the estimation of the organic matter in waters is to be of any value at all as a means of judging of their salubrity, it is essential that it should be done accurately. If it is to be a fundamental datum on which Municipalities are to choose or reject certain waters for the supply of large towns, that sanitary boards are to draw conclusions from as to the healthiness of certain localities for the residence of troops or other collections of human beings, and on which medical men and hygeists are to reason respecting the origin of disease or the maintenance of health, it is unnecessary to say that it ought to be ascertained in a reliable manner.

In the case of my own results, differing so widely from those referred to, the question occurs, is there no way of accounting for them or reconciling them? One cause has been suggested to me independent of correctness of method of analysis or of accuracy in its execution, namely the age of the water when examined, that is the length of time which had elapsed since the water was taken from its source. High chemical authority has been adduced for the necessity of setting about the analysis with the least possible delay, on account of the chemical changes which the water would undergo by keeping, which would result in a diminution of the quantity of organic matter present. The validity of the caution I am not disposed to deny, neither am I prepared to deny that in my own operations this point was not always sufficiently attended to. Indeed it had not particularly attracted my attention; except as regards gaseous constituents the point had not been particularly noticed either in text-books or monographs I had seen, and the consideration that the organic matter collected by rivers had already been freely exposed to decomposing agencies, so that probably what remained was not readily decomposable, confirmed as this was by my own observations while operating, led me not to attach much importance to it. Still it appeared that there might be a change of considerable amount shortly after collection which had passed unnoticed, while afterwards the water remained less liable to change. A small change, experiment shewed, did occur speedily, but the present question did not refer to a small change but to a large one, and it was desirable if possible to ascertain to what amount it might extend. The question principally concerned the waters of the hot season and of the rainy season.

So far as general observation could go, having been engaged in collecting and examining the river water from 1st May to 14th June for the purpose of ascertaining the amount of tidal contamination, I had abundant opportunities of judging of the physical characteristics of the water and observed nothing particular except a comparatively slight, somewhat fetid smell, which contrasted distinctly with the very decidedly worse smell of the water after the rains had come on, and of which the personal use of the river water gave me a vivid illustration. Other differences I have already noticed in the earlier part of the communication, all suggesting the greater proportion of organic matter in the water of the rainy season, at least in the earlier part of it. Moreover looking to the absolute weight of organic matter, I had only found even in the worst of the tanks, when their water was low and putrid, four or five grains in 100,000 fluid grains of water, equal to rather less than three or four grains per gallon; while the river water at any season was much superior to these in smell and colour, even during the rains, that is after the mud had settled.

Yet as these observations might not be sufficiently precise, experiments were instituted to endeavour to determine the question. The oxidation of the organic matter by permanganate of potash offered the readiest and easiest way of examination, and was applied to various samples of water, more particularly to determine the rapidity of change after collection. And it did indicate a rapid change even in course of a day or two, indeed the greatest amount of change took place within the first 24 hours. But it has already been pointed out that this test indicates the proportion only of certain kinds of organic matter, and gives no information as to the total amount. It may even indicate more oxidizable matter after the amount by weight of organic matter has diminished, as was really the case in some of the experiments made. This will be seen in the case of the mixtures in the succeeding table, in which the proportion of oxidizable matter diminished for the first few days, and then increased decidedly, afterwards diminishing again. In No. 3 mixture it increased to a large extent up to time of writing this, and no doubt would diminish afterwards. The great extent of change in this case is accompanied by a great diminution in weight.

The question at issue, however, was the amount by weight of



organic matter present. It was impossible of course to get the hot season water in its original condition, but experiments could be made with river and tank water, and with mixtures intended to imitate the real or supposed peculiarities of hot season water. These could be examined to ascertain the amount of change produced on them by keeping. Accordingly experiments were made the results of which are exhibited in the following table.

| Date of collection<br>or preparation.                                      | Date of Expt. | For 100,000 fl. grains W.  |                         |
|----------------------------------------------------------------------------|---------------|----------------------------|-------------------------|
|                                                                            |               | Organic matter.<br>Grains. | Oxygen reqd.<br>Grains. |
| <i>Calcutta Sewage Water.</i>                                              |               |                            |                         |
| 13th Sept. 1866,                                                           | 13th Sept.    |                            | 2.300                   |
|                                                                            | 14th          |                            | 2.040                   |
|                                                                            | 15th          | 21.80                      |                         |
|                                                                            | 17th          |                            | 1.470                   |
|                                                                            | 27th          | 10.75                      |                         |
| <i>Mixtures of River Water with Sewage.</i>                                |               |                            |                         |
| No. 1, containing $\frac{1}{3}$ th Sewage.                                 |               |                            |                         |
| 10th September.                                                            | 10th Sept.    | 5.44                       | .535                    |
|                                                                            | 11th          |                            | .480                    |
|                                                                            | 15th          |                            | .422                    |
|                                                                            | 24th          | 3.63                       |                         |
|                                                                            | 25th          |                            | .624                    |
|                                                                            | *2nd October, |                            | .203                    |
| No. 2, containing $\frac{1}{12}$ th Sewage.                                |               |                            |                         |
| 11th September.                                                            | 11th Sept.    |                            | .245                    |
|                                                                            | 12th          | 2.18                       |                         |
|                                                                            | 15th          |                            | .163                    |
|                                                                            | 24th          | 1.88                       |                         |
|                                                                            | 25th          |                            | .441                    |
|                                                                            | *2nd October, |                            | .353                    |
| No. 3, containing $\frac{1}{8}$ Sewage and $\frac{3}{8}$ Barn. Tank Water. |               |                            |                         |
| 18th September.                                                            | 18th Sept.    | 6.05                       | .420                    |
|                                                                            | 26th          | 2.65                       | .725                    |
|                                                                            | *2nd October. |                            | 1.938                   |

Introduced after date of paper.

| Date of collection<br>or preparation. | Date of Expt.   | For 100,000 fl. grains W.  |                         |
|---------------------------------------|-----------------|----------------------------|-------------------------|
|                                       |                 | Organic matter.<br>Grains. | Oxygen reqd.<br>Grains. |
| • Cornwallis Square Tank W.           |                 |                            |                         |
| 14th May, 1866.                       | June            | 5.15                       |                         |
|                                       | 21st May,       |                            | .209                    |
|                                       | 20th June,      | 4.40                       |                         |
|                                       | 11th August,    |                            | .155                    |
|                                       | 6th September,  | 4.37                       |                         |
| Baranagar Tank W.                     |                 |                            |                         |
| 15th September.                       | 15th Sept.      |                            | .350                    |
|                                       | 17th            | 2.38                       |                         |
|                                       | 29th            | 2.16                       | .256                    |
|                                       | *2nd October,   |                            | .228                    |
| Dalhousie Square Tank.                |                 |                            |                         |
| 18th September.                       | 19th Sept.      | 1.59                       | .100                    |
|                                       | 29th            | † 1.89                     | .070                    |
| River Water.                          |                 |                            |                         |
| 8th August.                           | 17th August,    | 1.08                       |                         |
|                                       | 25th Sept.      | 1.01                       |                         |
| 18th September.                       | 18th            |                            | .085                    |
| cleared by                            | 19th            | 1.69                       | .044                    |
| ▲acid                                 | 29th, more than | ‡ 1.36                     | .046                    |

The Mixtures were composed of river water of the hot season three or four months old and of recent river water with a little Salt Lake water, No. 3 containing also Tank water; with these were mixed the specified proportions of sewage water which had been collected on 8th September, and, as tried on the 9th, contained 27.33 grains organic matter in 100,000 fl. grains.

It will be observed that in the organic matters oxidised by the permanganate of potash there is a distinct diminution early, even by the lapse of a single day, as indicated by the smaller quantity of oxygen

\* Introduced after date of paper.

† Evidently an error of Expt. The organic matter could not increase.

‡ Exp. faulty. Enough of Carb. Soda had not been used. Result could not have been less, but probably would have been greater, had it been correct.

required subsequently; afterwards the diminution is slower, or in some cases even an increased quantity of oxygen may be required, from changes taking place in the water causing the production of a larger quantity of readily oxidisable matter. This therefore gives no indication of the weight or actual quantity of organic matter present. The weight of organic matter ascertained by experiment however, indicates in some cases a rather rapid diminution at first. But this is only to a small amount, except in the case of highly decomposable or putrefying liquids, such as sewage or mixtures containing much sewage. Calculation will show that the loss of weight of organic matter in mixtures Nos. 1 and 2 is less than would have been sustained by the constituent proportion of sewage water in them. In No. 3 probably the vegetable matter of the Tank water added caused the more rapid and extensive decomposition.

The loss of weight in the mixture No. 3 is 3.4 grains in 8 days, being fully more than half of the original amount; in Nos. 1 and 2 it is only only 1.8 grains and 0.3 grain respectively.

But the river water at no time could contain anything like the proportion of sewage that these mixtures did, such as one-fifth, one-eighth or even one-twelfth of sewage, the smell alone of such mixtures makes the supposition quite inadmissible; besides a comparison of the size of the river with the amount of drainage of the town would show that such a proportion was quite impossible. The amount of liquid discharged by the drains compared with the volume of water in so large a river must be insignificant.

But instead of citing results of my own, which if incorrect may be supposed to be all equally incorrect, it may carry more weight to quote the results of others. The older determinations of organic matter are generally of no value whatever, and I shall refer only to the most recent and trustworthy. I have already quoted Dr. Frankland's results with the London waters, but as all these are of water filtered for distribution they may be considered not quite comparable. Another example I shall adduce from the paper of Lawes and Gilbert in the *Journal of the Chemical Society* already quoted. They give tables of the composition of the Rugby sewage from May 1862 to October 1863, shewing that it contains in solution from 7.6 to 8.35 grains per gallon, and also a statement of the amount in the River

Wandle before receiving the Croydon sewage which is 1.44 grains per gallon, and after receiving it which is 2.08 grains per gallon. According to this the estimates of organic matter to the extent of 8 or 10 grains per gallon in the Hooghly water during May and June shew that it contains fully more than the liquid part of the Rugby sewage, and this in a tropical country.

I do not wish it to be understood that I maintain the perfect accuracy of my own results. The oversight in not examining the samples speedily enough after collection must be admitted, though from all that I have been able to learn from the experiments instituted for the purpose, the error cannot be a great one. There was no great delay in examining the water of the hot season,—about ten or twelve days, and this caused by the time and attention taken up in examining the influence of the tides in numerous samples. There was greater delay with the water of the rainy season, probably about a month with the first samples in July, about a week or 10 days with those of August. This was caused by waiting for the settlement of the very finely divided clay, the presence of which was very unfavourable to the accurate estimation of the organic matter. Recently I have found that the addition of a small quantity of hydrochloric acid causes the mud to settle so rapidly that the water may be filtered clear in course of a few hours: solution of potash or soda and milk of lime do the same, but the water cleared by these reagents seems to contain a different proportion of organic matter than that cleared by simple subsidence. It is of less importance, as the question at present is not respecting the water of the rainy season. The samples of December and February water circumstances prevented me from proceeding with, and they were preserved in stoppered bottles and probably not much done with them till April. The results are consequently more doubtful, though I do not suppose that they are very wide of the truth. As the season advances, should circumstances admit of it, I shall not fail to repeat the analyses, in order to get unobjectionable results.

The observations made during the last month enable me to add a little to my former statements respecting the effect of the change of seasons on the river water. The increase of organic matter from the rains seems to be chiefly of the more soluble and putrescible kinds; as

the season has advanced, the fetid smell has materially diminished. This is indeed to have been expected: the soil has been washed comparatively clean, and there is less of such matter to wash away.

The only possible way in which my results as to the small quantity of organic matter in the water of the hot season (supposing there is no great error in the analysis) can be reconciled with the results of those analyses that give it as equal to 8 or 10 grains per gallon, would be to suppose that the water at that season contains a large quantity of organic matter having no very offensive smell, but capable of very rapid decomposition, so that about  $\frac{1}{3}$ th to  $\frac{1}{10}$ th of it would be lost during the first two weeks. Without denying the possibility of this, I can only say that I know of nothing that makes it probable that such is the case, while I have already given reasons for believing that no such state of matters exists. Further observation and experiment can alone decide the question beyond doubt; while I may remark that if such be the case, it will be a fact well worth noticing and establishing.

It may also be observed, that as in the case of supplying towns the water must always be stored for a time in tanks or reservoirs, it is a point of some importance to note the changes which it undergoes by keeping in these circumstances. I have made some observations in the course of these enquiries suggestive of further investigations on this subject, and which may also have a bearing on the purification and preservation of such waters, a subject which has lately been occupying much attention in England. It is obviously a possible thing that one water may be putrefying but its putrescibility nearly exhausted, while another may be highly putrescible, and yet its actual putrefaction may be only about to commence. As regards the preservation of waters too, it is one thing to keep them in stoppered bottles, and another thing to keep them in tanks. It seems to me questionable if they improve in tanks as they do in glass bottles. It is by following out such inquiries that advance in knowledge of such subjects is attained, and in the present case the activity of chemical changes produced by the high temperature and the regularity of the seasons are in no small degree favourable for carrying them to a successful result.

*Kashmir, the Western Himalaya and the Afghan Mountains, a geological paper by ALBERT M. VERCHÈRE, Esq., M. D Bengal Medical Service, with a note on the fossils by M. EDOUARD DE VERNUEIL, Membre de l' Académie des Sciences, Paris.*

(Continued from page 203, of No. III. 1866.)

CHAPTER III.—*Cursory Survey of the several chains of the Western Himalaya, the Afghan mountains and their dependencies. Preliminary geological mapping of the Western Himalayan and Afghan Ranges.*

59. It is intended, in this chapter, to give, in as few words as possible, an idea of the general geology of the several portions of the Western Himalaya, the Afghan mountains and their respective dependencies. In doing so, I have availed myself of all sources of information which have been opened to me; I have, however, been sadly in want of the help of a more extended library, and I have never seen some excellent works which would have much improved this chapter, if they could have been consulted. I need therefore hardly say that it is a most superficial of surveys; but I hope nevertheless that it may be found to contain a few interesting observations and some new matter yet unpublished. Such as it is, it will enable us to sketch at least the first preliminaries of a geological mapping of the Himalayan and Afghan Ranges; and also to attempt, in the last chapter, to draw the history of the mightiest mountainous mass of our globe.

By reference to the map and and to the long Section (Sect. G) it becomes evident that the Himalayas are a succession of more or less regularly parallel chains, having a general N. W. to S. E. direction. Between the chains are situated valleys which are elevated above the sea in proportion as one nears the centre of the mountainous mass: thus the Rawul Pindie plateau, between the Salt Range and the Sub-Himalayan hills, is about 1700 feet high; Poonch valley, between the Sub-Himalaya and the Pir Punjal chain, is under 4000 feet; Kashmir between the Pir Punjal and the next chain (called in the map Ser and Merchain), is above 5000; Ladak between the Ser and Mer chain and the Kailas chain is 10,000 to 11,000; Nubra and the valley of the Shayok,

between the Kailas and Korakoram chains is a plateau nearly 15,000 feet high. It is probable that on the other side of the Korakoram chain the elevation diminishes and that the Aksai chain and the valley of the Yarkandkash river, between the Korakoram and Kuen-Luen chains, are about 10,000 feet high; beyond the Kuen-Luen is the province of Kotan which has been satisfactorily determined by its vegetation to be no more than 5000 feet high.

We have therefore a series of steps rising from the plains of the Punjab to the high plateau of Little Thibet, and descending from Little Thibet towards Turkish China. These steps are supported by parallel chains or walls which tower by some thousands of feet above the plateaux which they support. These chains offer a considerable impediment to the flow of rivers towards the plains, and most rivers have a considerable course parallel to the direction of the chains, before they can find a gap to pass through.

The Afghan mountains present the same arrangement as the Himalayas; the direction is from the N. E. to S. W. the direction of parallel chains is less well marked than in the Himalaya, but this is probably due to the little which is correctly known of the topography of these mountains. The plateaux are similarly graduating: Bunnoo being about 1200 feet above the sea, Kabul 7000 feet, Kaffiristan higher, whilst the plateau of Koonduz, on the other side of the Hindoo Koosh, slopes gradually towards the west. This arrangement by plateaux is the same as is seen in the Andes with their high central chain and their plateau between that chain and the Cordilleras.

From the hypothesis, advanced in the next chapter, of the manner the Himalayan and Afghan mountains were upheaved, we will deduct which of the lower hills belong to the Afghan and which to the Himalayan mass, and I will therefore not discuss this subject here, as it would but lead to useless repetitions. I shall begin with the hills which one first meets crossing out of the alluvial plain of the Punjab, as he travels north from Mooltan; and I shall take the parallel regions of the Himalaya one after the other, noticing as I go on whatever little I know of the geology of the Afghan mountains in the same latitude.

60. In latitude  $32^{\circ} 10'$ , longitude  $70^{\circ} 50'$  to  $71^{\circ} 20'$  rises the double chain of the Kafir Kote range or Rotta Roh and the Sheikh

Bodeen range. A small valley, the Paniala valley, separates the Rotta Roh range from the Sheikh Bodeen range, and the direction of both small chains is from the N. E. to the S. W. as far as the highest summit of Sheikh Bodeen, whence westwardly the Rotta Roh altogether disappears, and the Sheikh Bodeen range is continued by a small and low ridge of hillocks directed towards the W. N. W. and supporting the plateau of Bunnoo. (See map.)

The Rotta Roh is mostly composed of carboniferous limestone. The Zeawan bed is well developed, but extraordinarily disturbed; it is a yellowish rock, often very sandy. It forms the base of the hills on the E. and S. E.

Dr. A. Fleming sent home some fossils from Kafir Kote, which were ascertained by M. de Verneuil to belong to the following species:—

*Productus cora* (D'Orb.); *Productus costatus* (Sow.).

*Productus Humboldtii*, (D'Orb.) *Spirifer*?

*Dentalium ingens*, (DeKönig).

All the species of which I have given drawings in Pl. I, III, and V, were found in the Rotta Roh limestone, with the exception of the *Spirifer* like *S. trigonalis*.\* Several species of corals, either not found at all or very rare in Kashmir, were found abundantly in the lower beds of the Rotta Roh; but altogether the fauna of the Zeawan bed in Kashmir and in the Rotta Roh is so very similar, that it can be called identical.

The limestone rests† on a quartzite rather peculiar in some localities. It is composed of opaque white quartz in which are imbedded plates of pearly white mica half an inch wide; these plates of mica are arranged in tufts; there are also some irregular nodules or granules of black augite (?) quite lustreless (see fig. 74, pl. IX). There can be

\* A distinct species of Sp., according to Mr. de Verneuil.

† I failed to find the bed of quartzite in situ; my examination was much more superficial than I could wish. But it is hardly to be wondered at that the quartzite beds are not found in situ, if we consider the wonderful state of confusion the beds are in. The limestone is in an extremely shivered condition, having been thrown into stray arch-like anticlinals separated by numerous faults. The shivering of the beds often goes so far that it is difficult to ascertain the dip and strike of the beds. In such convulsions as those which must have taken place in these hills, the brittle and fragile beds of quartzite must have been entirely broken, and are therefore not to be seen in situ at their outcrops, but are only indicated by the fragments into which they were reduced. In several localities the ground is covered with angular pieces of quartzite, either with mica as described in the text, or plain and opaque.



no doubt that this micaceous quartzite represents the bed of quartzite which we have seen invariably underlying the Zeeawan bed in Kashmir. The beds of volcanic ash which it probably covers are not exposed in the Kafir Kote Range.

The Zeeawan bed of limestone is capped by very extensive and thick beds of Weean limestone rich in goniatites, in mussel-like *anthracosia*, in *Aviculo-pectens* and other characteristic fossils. I found some blocks of the sandy limestone in which the *anthracosia*, *solenopsis* and *A. pectens* are generally found, containing one specimen of *Productus semireticulatus*, several *Athyris subtilita* (Hall) and *A. Royssii* (L. W.), and also the *P. Bolivicutis* (D'Orb.) mixed up with the *anthracosia* and *A. pectens*, a mixture of Zeeawan and Weean fossils which I never saw in Kashmir. Some very large bivalves of which debris had been found in Kashmir and resembling an aviculoid inequilateral *pecten* were also found; the transverse diameter is  $7\frac{1}{2}$  inches. Fine *nautilides* and spines of *cidaris* six inches long were also found. In the Rottah Roh the difference between the Zeeawan and Weean beds is not everywhere so well marked as it is in Kashmir, as I have just exemplified; generally, however, the assemblage of fossils given in the plates as characteristic of the beds is the same as it is in Kashmir.

In the northernmost end of the Rottah Roh, the Zeeawan bed does not appear, and is only represented near Kumdul by a few small mounds of debris rising through the sandy plain close to the foot of the hill. As we travel south and approach the Kafir Kote river, the Zeeawan bed appears under the Weean, and can be traced without interruption as far as the southern end of the hill a few miles from Paniala. It is impossible to give the dip and strike of the Zeeawan bed, as not a hundred yards of it keeps the same direction; the broken fragments of the bed are more like packed ice in the polar seas than like courses of rock in a hill. The Weean bed above is much less disturbed, except the deepest beds which rest immediately on the Zeeawan; it dips generally N. W. with a very trifling angle varying from  $20^{\circ}$  to  $8^{\circ}$  or  $9^{\circ}$  with the horizon; occasionally the dip becomes W. and even S. W.

I have not seen any beds in the Rottah Roh similar to the Kothair bed of Kashmir.

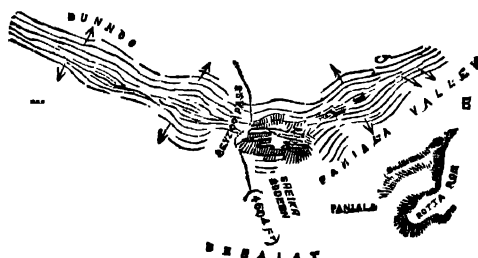
At the northern end of the Rottah Roh, the carboniferous limestone is immediately covered in by a Miocene sandstone and conglomerate. A little further south, some beds of reddish limestone and some sandstones, grey and bituminous, are either the top of the carboniferous or possibly Permian or Triassic beds. The fossils are very scarce and mere debris. The sandstone contains thin layers of a shale which is full of carbonized remains of plants, and from the sandstone, near the shale, a black bitumen oozes out. It is a mineral pitch or impure petroleum; the quantity is insignificant.

As we continue to travel south and west, we find the Weean bed forming the top of the hill the whole way; with here and there patches of gypseous marls, red marl, grey sandstone and variegated thin-bedded non-fossiliferous limestone, or rather dolomite, which are in all probability Triassic, but which will require much more careful study than I have been able to give them, before they can be satisfactorily classed. I believe them identical to the red marl and gypsum of the Saliferian formation of the Salt Range. Close to the village of Paniala these supposed Triassic beds are well developed, and from them issue some saline hot springs. Near Gunga, at the other (northern) extremity of the little Range, a patch of these same gypseous sandstones and marl appear at the end of a fault in the carboniferous limestone, and from these supposed Triassic beds two or three small hot and saline springs issue. It is a remarkable fact that everywhere in the Himalaya and in the hills of the Punjab, where these gypseous marls, red marls, sandstones and dolomites appear well developed, they are generally accompanied by saline springs, usually hot.

At the northern extremity of the Rottah Roh, over the village of Kundul, we have seen that the Weean limestone forms the bulk of the hill. Under it, at one place, is found a feldspathose sandstone invaded by tortuous veins of quartzite; it has acted powerfully on the limestone near it, this being much metamorphosed, cellular, traversed in all directions by thick bands of crystalline carbonate of lime, and all fossils being obliterated or changed into a lump of spar. The feldspathose sand has the appearance of having been forced between the broken ends of the beds of limestone which is thrown into an anticlinal; it is generally white, occasionally coloured

red in patches; it is not stratified, but mammilated, globular, irregular, and branching like a dyke. This intrusion of a feldspathose solution or paste took place before the final upheaval of the Himalayas, as there is evidence that some of the beds have been redisturbed by this upheaval, and as the Miocene conglomerate which partially fills the fault is unconformable to the limestone. A full description of this locality would be complicated, and I have no intention of giving here such a description. I merely want to point out that we have here Weenan beds disturbed and baked by a geyserian action, similar to that which we have seen at Ishlamabad and at the Manus Bal.

61. The Sheikh Bodeen Range is mostly composed of miocene sandstone, clay and conglomerate. These beds are thrown into an anticlinal, the south-eastern and southern slopes dipping to the S. E., and the S. and the north-western and northern slopes dipping N. W. and N. One can see, from the top of the highest summit, that deeper rocks have endeavoured to push their way through the miocene, the beds of sandstone and conglomerate being arranged in semi-theatres on both sides of the points where an underground mass has endeavoured to break through. But everywhere these underground masses have failed to find a way to the surface except at one point, viz., the Sheikh Bodeen summit, in the centre of the Range. This summit is 4604 feet above the level of the sea, whilst the Miocene range does not reach higher than 2800 feet and is generally very much lower.\* There is evidence that the Miocene was at one



Horizontal appearance of the Miocene beds, Sheikh Bodeen range.

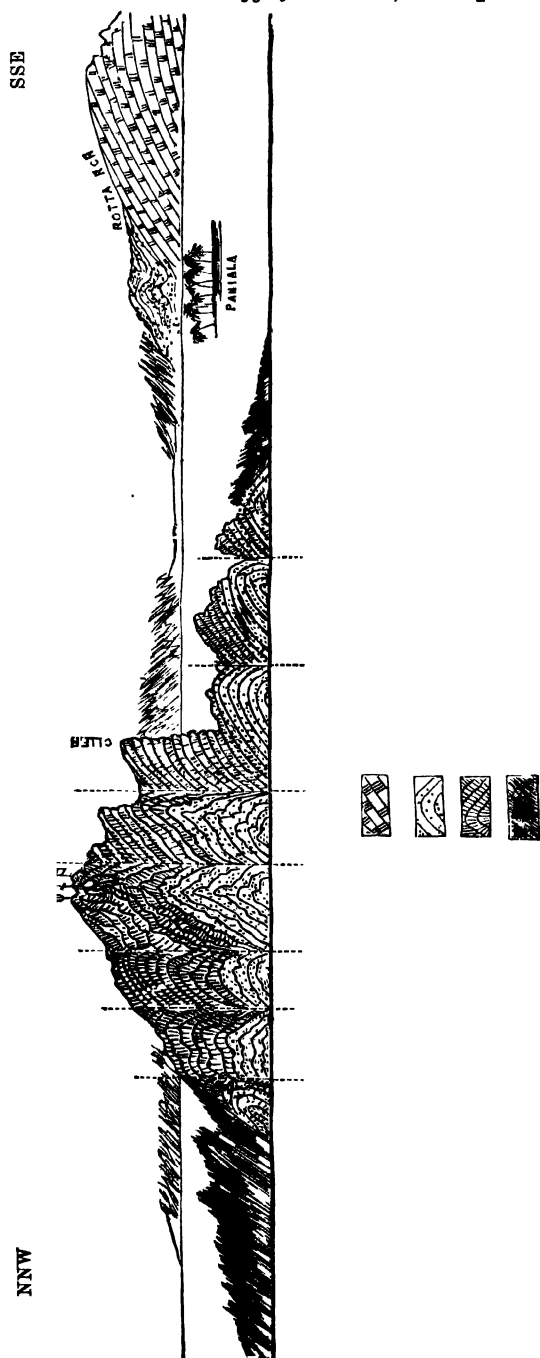
time much higher and reached to within 8 or 900 feet of the summit of Sheikh Bodeen. But the friable sandstone and loose conglomerate disintegrate very quickly, whilst the limestones of Sheikh Bodeen summits decay but slowly; hence the Miocene portions of the Range

have become low hills, whilst Sheikh Bodeen summit has nearly retained its original height, and appears therefore to stand now as an isolated summit in the middle of insignificant, low, barren and crumpling sandstone and conglomerate hillocks.

Sheikh Bodeen hill (not range) is mostly composed of Jurassic limestone, excessively shattered from having been thrown into a succession of very sharp anticlinals. The anticlinals are separated by faults which run from W. S. W. to E. N. E. The following diagram sections are from the N. N. W. to the S. S. E.

*Sections V and VI General Map.*

The section in the distance is about a mile north of the section through Sheikh Bodeen Hill. Jurassic limestone is at least 800 feet thick; it is rich in fossils which are, however, seldom well preserved. The lower beds contain *Belemnites*, *Ostræa*, *Rhynchonellæ* and *Terebratulæ* in great abundance, especially in and near some ferruginous sandy beds. Shaly beds are full of petrified branches of trees. The limestone is sandy and impure; along the great cliff facing the S. S. E. and formed by the removal of half the arch of an anticlinal (see section, marked cliff) some very fine specimens of ripple-marking are exhibited on a large scale. *Ammonites* are also found, but very much broken. *Cariophyllides* and an *Astræa* are the commonest corals. Two or three species of *Pholadomya* are tolerably abundant. In the uppermost beds I have found a *Nerinæa*, very likely the *N. Bruntrutana* (*Thuma*) of the coralline. In both the lower and upper beds the mineral characters appear to be identical, and many species of fossils are common to both, especially *Rhynchonellæ*, of which no less than ten species are abundant. In the lower beds I have found eight species of *Terebratulæ* with short loops, or true *Terebratulæ*. The *Belemnites* are three or four species, of which a thick one like the *B. sulcatus*, a grooved species like the *B. canaliculatus*, and a hastate species like the *B. hastatus* are the most abundant. Gasteropods are extremely abundant in some beds, most especially a species of *Acteonina*; a few encrinite stems were found, but no heads.



From this fauna it appears therefore that the limestone of Sheikh Bodeen\* is equivalent to the Oxfordian formation of England, and that the uppermost beds are contemporary to the English Coral Rag or rather to the *Calcaire à Néimaes* of the Zena. We shall see presently in the country of the Wuzerees, beds which are, in all probability, the equivalent of the Coral Rag. Some of the Oolitic shells collected by Dr. Gerard in Spiti are represented in Dr. Royle's Illustrations of the Botany and other branches of the Natural History of the Himalayan mountains; the drawings are by T. Sowerby and are remarkably good. ● The form numbered 17 in Royle's plates and described as an *Arca* or *Cucullæa* is found at Sheikh Bodeen; the *Rhynchonella* 20 and 21, described as *Terebratulæ* or *Atrypæ*, are common at Sheikh Bodeen; the two species of *Ammonites*, figs. 22 and 24, are also found at Sheikh Bodeen, as well as the two species of *Belemnites* represented figs. 25 and 26 and fig. 27. The fig. 23, called a *Delthyris*, has also been found at Sheikh Bodeen, I believe, but I do not possess a specimen of it.

The *Rhynchonella* represented by Royle and which is common at Sheikh Bodeen, has also been found in Rukshen by Captain Austen.

The Jurassic limestone of Sheikh Bodeen rests in variegated dolomitic limestone without fossils (?), red marls, gypseous dark marls, and feldspathose white sandstone extremely friable; and this formation appears identical to the Saliferian formation of the Salt Range. From these lower beds issue a few small springs of brine, and it is, probable that masses of salt exist here and there in the marl, as it does in the Salt Range, but nowhere does the salt crop out. Some beds of massive gypsum occur on the southern side of the hill near its base, but are not extensive. The Oolitic and Saliferian formations conform in all their folds, faults and twistings most perfectly, but there is a slight nonconformity between the Saliferian and Oolitic beds and the Miocene sandstone and conglomerate. The Saliferian and Oolitic formations had been upheaved to some extent before the Miocene began to be deposited, as boulders of gypsum and Oolitic limestone are found in the Miocene conglomerate in company with boulders of volcanic rocks, of nummulitic limestone, of carboniferous limestone, and with rolled *Producti* brought from the Bilote Range. But the

\* A few fossils of Sheikh Bodeen are sketched at Plate XI. figs. 2 to 6.

hills formed by the first upheaval were so low, and their beds probably so near the horizontal position, that the non-conformity of these beds and of the Miocene beds is not now very apparent, both sets of beds having been redisturbed to a great extent by the final great upheaval of the Himalayan mountains.

62. In the country of the Wuzerees, lat. N.  $32^{\circ} 15'$  to  $32^{\circ} 45'$  and Long. E.  $69^{\circ} 45'$  to  $70^{\circ} 15'$ , we find the continuation towards the north of the Soolimane Range to be formed of a chain of mountains of which the Pir Gul (11,583) and the Shewy Dhur (10,998) are the highest summits. These high summits were not ascended by the expeditionary force against the Mosood Wuzerees in 1860, but the army marched along the fine plateau of Rasmuk (7,000 ft.) which skirts the main chain; and by collecting the pebbles of the torrents which descend from these high peaks I was enabled to estimate to a certain extent the mineral nature of the central ridge. These pebbles were all volcanic, trappean and metamorphic, and none of a granitic nature were found. The following specimens of rocks were collected in ravines descending *directly* from the Shewy Dhur: basalt, having the appearance of hard jet; it is divided by joints and by innumerable cracks filled with carbonate of lime. It fuses quietly before the blow-pipe into a black bead. Some varieties do not shew the cracks filled with carbonate of lime, but are schistose in appearance, and the joints, which are large, are lined by quartzite. Half inch thick plates of volcanic ash, composed of a central layer of a pale dirty-greenish and compact mineral, and external layers of a brownish granular substance. The central layer fuses very easily before the blow-pipe, boiling up into a swollen and blistered surface; it has the appearance of tremolite, the outer layer appears to be a mixture of tremolite with grains of augite; the augite here and there forms little masses, and these fuse partially, the assay becoming studded with minute dark globules. Hornblende rock with grey mica. The paste appears to be an intimate mixture of felspar and hornblende, and is invaded by irregular and small plates of grey mica; the rock is divided by a series of well-marked joints, an inch apart. An augitic porphyry; the paste is perfectly black and apparently composed of chatoyant augite; it is invaded by closely set and minute prismatic crystals of dull white albite; it is more like a porphyritic lava than like a true porphyry.

A metamorphosed micaceous limestone, schistose, the foliation being extremely wavy. It has the appearance of a thin-bedded micaceous and calcareous shale which had been both crumpled and highly metamorphosed. It is nearly entirely composed of exfoliating mica imbedded into grey bands of magnesian (?) carbonate of lime, which effervesces feebly, and other bands of white felspar. The felspar forms bands by itself, a quarter of an inch thick and free of mica. The rock exhibits a foliation or stratification which is thin-bedded and wavy. Greenish, soapy, spotted chlorite schist. Jaspers flint, bluish and transparent, with veins and patches brownish and opaque, and occasionally threads of milk-white quartz. Quartzite with well formed crystals, six-sided prisms, at one end terminated by a six-sided pyramid.

These rocks are therefore mostly volcanic; the four last are, however, metamorphic, and such rocks are not seen in Kashmir; but they are extensively developed in the most northern portion of the Himalaya,\* as in Skardo, Zaskar, &c.

63. Between the range of the Pir Gul and Shewy Dhur and the plains of the Derajat, is a thick belt of low hills which are nearly entirely made up of nummulitic limestone, slate and shales, and of Miocene sandstone and conglomerate. At Palusseen, however, (see map) under the nummulitic limestone is discovered a rock of a very hard and dirty appearance and not forming beds, but huge masses of flesh-coloured limestone which are imbedded either in a grey sandstone or in the lower beds of the nummulitic limestone. These masses are most evidently old coral reefs, once rising from the bottom of the sea and ultimately covered by sand and calcareous mud; they are a confused agglomeration of corals of many species, imbedding shells, but unfortunately neither corals nor shells are in a good state of preservation. \* I am not sufficiently familiar with the forms of the Coral-Rag of England to say whether this bed is its representative in India, but it is not unlikely to belong to secondary strata, for the following reasons.\*

1. It is situated under the sandstone, which generally forms the base of the nummulitic formation.
2. It does not contain any of the

\* A coral reef formation, apparently closely analogous both in lithologic characters and mode of occurrence, occurs at the base of the Ootatoor division of the cretaceous rocks in Trichinopoly. See Mem. Geological Survey, Vol. IV, Pt 1, pp. 52-72.—*Ed.*



fossils found in the nummulitic limestone above. 3. It appears much disturbed and dislocated by local movements, whilst the nummulitic limestone is to be seen in regular, though much tilted-up beds above it. 4. It rests immediately over beds of red marl and gypsum which are always found, in the Punjab, where Oolitic beds occur much disturbed. 5. Some of the corals appear identical with some species found near Maree on the Indus, in a limestone containing the same fossils as those of Sheikh Bodeen which is decidedly an Oolite:

I have therefore, in consideration of these reasons coloured these beds as Oolitic, but there is a doubt about it. The country was so dangerous at the time we were encamped at Palusseen, that I could collect but very few fossils, and I have not yet had the good luck to discover a similar bed in British territory.

These coral reefs reappear in many places in the country of the Wuzerees: at the entrance of the plateau of Rushmuk a great quantity of this bed was again seen, but the rock was different, though the fossils were identical; the limestone was extremely impure, full of small rounded grains of gravel, and so much invaded by iron that it is often quite brown, and often also spotted by the iron forming little dark nodules in the mass.

Again, near the hot spring of Sir-Oba, similar beds were seen resting on red marl, with here and there masses of gypsum. This gypsum is opaque, white and compact, and contains a great number of crystals of quartz, very fine in their form, and terminated at both ends by a six-sided pyramid. The same crystals occur at Matee and Kalabag in the gypsum which accompanies the rock-salt of these localities, and are there collected and sold to natives as ornaments, under the name of Kalabag diamonds.

One of the members of the nummulitic genus in the Wuzereee Hills requires notice on account of its economical value. The Wuzereee iron is obtained by the smelting of a brown shale, extremely rich in brown hæmatite; the beds of the shale are situated under the nummulitic limestone, and seem to replace the extensive beds of slate, with nummulites, seen in other localities. The quantity of the ore is enormous, whole ridges being formed of it. It is not quarried, as far as I could discover, but merely broken off the surface of the beds. It

is first roasted, and becomes black and highly magnetic. It is then worked either with nummulitic limestone or pieces of the coral-reefs and smelted with charcoal in small furnaces identical to those seen in Kashmir. I found at Mackeen a house with two of these furnaces and heaps of charcoal, of iron-ore and of limestone, evidently collected for smelting, and I could thus identify the ore used by the Wuzerees, though no information was to be obtained from the people. I have had, since, pieces of ore brought to me, at Bunnoo, by the Wuzerees engaged in trade and who bring the pig-iron to the plains for sale, and it is exactly the same ore which I had seen at Mackeen, and which I had observed in situ as one of the members of the nummulitic formation. This shale is heavy, generally covered with a rusty powder; it varies in colour from reddish-brown to nearly black; it soils the hand, it is not calcareous, and the richest parts of it have a tendency to form concretions, or at least to assume a sort of concentric slaty cleavage. It is only smelted to a paste, not to a fluid, and is refined by hammering. The iron produced is soft and fine-grained, but apt to exfoliate, a defect which is evidently the result of the metal being half worn-out by the extensive hammering to which it is submitted.

The carboniferous limestone was found in situ in Wuziristan. But that such rocks do exist in the hills between the British border and round the central chain of the Afghan mountains, is proved by the boulders in the rivers which drain those countries. Major Vicarey found boulders of limestone containing carboniferous fossils in the streams near Peshawur; Dr. Fleming found "*Productus*-limestone" in the ravines which drain the Solimane chain towards the east; and I have found in the bed of the Korum, a torrent which drains the southern slopes of the Sufed Koh, boulders of a black limestone containing *Productus cora* and *P. Humboldtii*.

64. In the Salt Range the carboniferous limestone is well developed and attains, according to Dr. A. Fleming, a thickness of 1,800 feet. It begins near Noorpoor in Long. E.  $72^{\circ} 30'$ , as a thin bed, which increases as it goes towards the west, and attains its maximum of development near Vurcha, in Long.  $72^{\circ}$ . It decreases again towards the Indus, and is not seen at all near Maree and Kalabag; but on the right bank of the river it reappears about six miles west of Kalabag, and is continued in the Chichalee range and the northern

end of the Speen or Loma Gur. It appears to be identical, in fossils and in lithological characters, to the limestone of Kashmir. Dr. A. Fleming does not mention its ever resting on quartzite or volcanic ash, but supposes on the contrary that it rests on the Saliferian formation, which he, in consequence of this view, calls Devonian. Whatever little of the carboniferous limestone of the Salt Range I have myself seen, is too much disturbed to allow me to form an opinion; I certainly never saw any quartzite underlying the limestone in the Salt Range; but such quartzite exists in the Rottah Roh, and it is evident that the Rottah Roh carboniferous limestone, and that of the Salt Range are one and the same sheet of deposit, broken and separated by convulsions of a posterior age. This, however, does not prove much either way.

The long controversy about the age of the salt and gypsum in the Alps bids fair to be repeated in the Punjab. The Saliferian of the Salt Range has already been placed by successive observers in nearly every formation from the Devonian to the Miocene! In the Alps, geologists appear to have once become desperate at the fight, and M. Sismonda published in the *Comptes rendus de l'Académie des Sciences de Paris* (Vol. III. p. 113) the somewhat startling hypothesis that "in the Alps the shells of the Lias lived at the same time as the carboniferous plants"!!!... It is not a little curious resemblance that in the Maurieune, in Savoy, (the great field of contention,) the gypsum, quartzite, marl, &c., are much disturbed by local foldings and bendings, and appear to be placed under the carboniferous rocks (*terrain houiller*). Fortunately a thin, but very persistent and well-characterised bed, the *Infra-lias*, has enabled the geologists who have best studied this locality, to fix the position of the red marl, red and green shale, quartzite, gypsum, &c., in the Trias, and to show that the apparently inferior position of these Triassic layers was due to such great disturbances and reversions of strata as one may reasonably expect to have accompanied the surging up of mountains like the Alps. Less fortunate or less industrious than they of Europe, we have not yet found the *Infra-lias* in India, and we have not therefore got hold of the thread which led so successfully the Swiss and French geologists to a true understanding of the Alpine Saliferian.

I wish that I could have determined satisfactorily the age of the

salt of the Punjab, before forwarding this paper to the Society ; but I see at present but little chance of my being able to visit again and study the Salt Range within a reasonable time. My own impression, from what I have seen, is that the Saliferian of the Punjab is Triassic or Permian.

This Saliferian formation, (whatever its age may be,) plays a very important part in the economy of Upper India, and may possibly be made a great deal more of than at present. It gives a supply of salt which pays to the State a handsome revenue ; it has been the original source of the Reh or Kullur of the soil, an impure and effervescing mixture of saltpetre, of soda and chloride of sodium, which renders fields barren and thus causes very serious losses to that same revenue. There can be little doubt that it contains some at least of the numerous minerals discovered in the Russian salt mines of Stassfurt-Anhalt, and it is very possible that it will one day give some fertilizing material which will more than repay the loss caused by the Reh. It is a fine field for research, and only wants work bestowed upon it to yield valuable results.

Any one who has visited the Saliferian of the Punjab must have been struck by the much disturbed state of the beds. These appear as if they had been raised into a succession of small cones or "boursofflures," and suggests at first sight the idea of the Saliferian having been at some time or another violently dislocated by eruptive gases and sublimated minerals. This is so marked in some localities that Dr. A. Fleming advances, as a possible hypothesis, that the salt may be of volcanic origin. But the stratification is generally so well defined (the courses of salt being separated by thin layers of red marl or of cellular gypsum) that we cannot regard the salt as intrusive ; it is decidedly sedimentary. That the disposition of the salt gypsum, bipyramidal quartz crystals, &c., &c., took place under the influence of heat, due probably to hot springs, is pretty certain. For Charpeutin and de Beaumont have shewn that the gypsum was first deposited as anhydrite, and this anhydrite must of necessity have been precipitated from hot solutions ; neither do we see how sea water could deposit gypsum, unless submitted to a high temperature ; whilst, high temperature being admitted, the precipitation of gypsum becomes easily explained, if we remember Mr. David Forbes's observation in Peru :

"The quantity of sulphates and more especially of sulphate of lime, included invariably in these deposits, might, at first sight, appear to the observer too great to suppose it due only to the evaporation of the sea-water; but I believe that this impression will be dissipated when he sees the enormous amount of gypsum removed in the form of hard white cakes or sedimentary crust, from the boilers of the large distilling machines in use along this arid coast, for producing from the water of the sea a supply of fresh water for the maintenance of the inhabitants, beasts of burden, and even the locomotive engines of the railways along the coast. It appears not necessary to suppose, as has been put forth, that the sulphates present have been formed by volcanic exhalations acting upon the bed of salt."\* What induces us readily to admit of the existence of very numerous and extensive hot springs during the Triassic epoch in the Punjab is, that even now-a-days the Saliferian formation is remarkable for the great number of hot springs it contains; indeed hardly a hot spring in the Punjab and the Himalaya is to be found unconnected with the Saliferian, and whenever we find Saliferian beds, we generally also find hot springs. This is true of the Salt Range, of the Rottah Roh, of Kangra,† of Rukshu in Thibet, &c. We may therefore conclude from these remarks that the salt, gypsum, &c., is sedimentary, though deposited under peculiar circumstances, viz., the presence and influence of hot springs. How then to account for the very disturbed state of the Saliferian beds, for these limited, local, fragmentary disturbances which give to the beds so elastic an appearance? Two ordinary causes appear to me sufficient to account for this: one is the transformation of the anhydrite into gypsum by absorption of water, a phenomenon which continues to take place now-a-days. This absorption of water and the consequent increase of volume of the gypsum brought about the swelling up of the beds in cones and "boursoufflures." Then the

\* "The Geology of Bolivia and Peru," by David Forbes, with notes on fossils, by Professor Huxley and J. W. Saller, Esq., published by Taylor and Francis, Red Lion Court, Fleet Street, 1861, communicated to Geological Society in 1860.

† The saline springs of the Towala Mookhi and of Kangra-basa, in Kangra, issue from Saliferian ranges immediately covered by Miocene beds. Mr. Marcadieu has found that the water of these springs contains Iodine, in addition to the usual saline matter of the springs of the Saliferian formation in Upper India. Vide Report, No. 84, by M. Marcadieu. Sketches of Correspondence, Punjab, 1860.

second cause of disturbance began to act: the beds of salt are often dissolved and removed by water infiltrating through cracks in the rocks; a cavity is thus formed under the vault of rock which covered in the salt and one day the vault falls in.

This process is to be seen now-a-days in actual existence, on a small scale, in the hillock of Maree on the Indus.

Thus, from the swelling of the gypsum by its transformation from anhydrite to common gypsum, and from the falling in of the vaults formed by this swelling, the beds of the Saliferian formation in the Punjab have a most broken and turned-over appearance.

Add to this that these beds have participated in the convulsions produced by the great final upheaval of the Himalaya, and you will have no difficulty in understanding how difficult it is to make out with certainty the stratography of these rocks, and how it is that the Saliferian appears here and there inferior to the Palæozoic beds. Before quitting the Saliferian formation, let us notice that the beds of it appear to have suffered very great denudation. We can easily understand that the red marl was very easily denuded, when we see how it crumbles into a powdery, friable, fluid earth, after a few days exposure to the atmosphere. It is on account of this denudation, on account of the very considerable amount of material which this formation gave to the Miocene and to the alluvium deposits of Upper India, that the presence of Reh or Kullur in the soil of the Punjab and the North-West Provinces is to be credited to the Saliferian. I shall say a few words about this again, when we explain how the Miocene was made up, in the next chapter.

As there is yet such incertitude about the age of the salt, I have called the formation "Saliferian," without entering it on the Map as belonging either to the Palæozoic or to the Mesozoic epoch.\* ●

The carboniferous limestone is covered in, north of Vurcha, by an Oolitic formation of trifling thickness and containing Oxfordian forms.

\* I have purposely avoided insisting on the mineral characters of the Saliferian formation of India, as it is now-a-days the fashion to undervalue very much these characters; but it may be as well to remember that in the Salt Range we have beds of gypsum full of rock-crystals of a bipyramidal shape; that the layers of gypsum are separated by calcareo-magnesian bands, having a cellular disposition (Cargneule of the Swiss, Rankwacke of the Germans) and that the salt is accompanied by a bright red marl without fossils. These several characters are found in the *Triassic* salt and gypsum of Switzerland, of Savoy and of Spain, and, I believe, in no other formation.

As the carboniferous limestone thins out in approaching the Indus, the Oolitic formation increases in importance and forms much disturbed hills, all the way from Moosa Khel to Kalabag. It is continued west of the Indus in the Chichalee Range and the northern end of the Speen Ghur; a little above Moola Khel it disappears under the alluvial, and does not reappear till Sheikh Bodeen, where, as we have seen, it attains a considerable thickness.

65. The salt and gypsum is continued on the west side of the Indus, in the hilly country of the Kuttuks, but it is there much covered by tertiary clays and sandstones. It crops out near Bahadoor Khel and along the course of the Teeree Towe. At the first named place the Saliferian forms an anticlinal arch; the salt, above fifty feet thick, is the lowest bed seen, and is very regularly stratified; above it is a thin bed of red marl, another of grey sandstone, also thin; then gypsum, about twenty-five to thirty feet thick; then a thin band of a limestone with minute debris of fossils, and which resembles lithologically the Oolitic bed of Kalabag and Maree on the Indus; then the dark, brown, sandstone which often forms the base of the nummulitic formation; some coarse and crumbling shales without fossils; and finally, a bed of limestone rich in nummulites, volutes, veneridae, &c., and about ten to twelve feet thick. This is at last covered by the marly lumpy clayey beds of Miocene. A fault running approximately W. E. through the Soordak Pass, has caused an up-throw of the beds on its southern side, and there the nummulitic limestone, much tilted up, forms a pretty high hill.

Along the Teeree Towe the Saliferian is immediately covered by Tertiary. As far as Lachee the rocks seen are Miocene sandstone, clay and conglomerates; thence to Peshawur the country is entirely covered by nummulitic limestone and shale, and the Miocene sandstone is only seen here and there in small detached beds and patches, which are evidently the remains of layers which have been mostly removed by denudation.

66. North of the Salt Range we have also a great extent of Tertiaries. Nummulitic limestone, shale and sandstone first covers in the secondary layers in the western portion of the range, but rests directly on the salt marl and gypsum in the eastern half of it. It attains a great thickness, where well developed, (4500 feet,) and forms

the summits of nearly all the highest hills of the Salt Range. It is continued to within 10 miles of Maree on the Indus where it thins out, but reappears near Kalabag, and is very well developed in the Chichalee Range and in the Speen Ghur. Near the Indus, all the beds of the Salt Range, excepting the Saliferian marl itself and the secondary strata where much locally disturbed, dip towards the N. E. On the western bank of the Indus, that is in the Chichalee Hills and the Speen Ghur, the dip is W. N. W. or N. W. This last dip is generally that of all the strata of the Kuttuk hills.

The nummulitic formation appears in the Salt Range as a thick belt which, beginning at the Mount Tilla near Jheelum, is continued to near Maree on the Indus, where it disappears for a little space, but reappears on the other side of the river, and is to be seen forming the bulk of the Speen Ghur to near Esokhel. The formation keeps a remarkably similar aspect the whole way. It is, from below upwards, composed\* of — 1. Sandstone often coloured by iron, but generally dirty white or pale grey. 2. Very arenacious, thin bedded or lumpy limestone, with gasteropods, few and small nummulites and innumerable debris of oysters or gryphææ. 3. Shales of various colours, with beds of lignite and of alum carbonaceous shales. The alum shales are only developed where the lignite is situated close to the Saliferian formation, and appear to be patches of lignite metamorphosed. 4. Argillaceous limestone, full of large nummulites, *chama*, *cardita*, *crassatella*, *ostrea*, many gasteropods, very large echinodermata, &c., &c. 5. Shales often replaced by a clay-slate containing nummulites. The shales contain sometimes lignite and *Rol* (alum-shale), but the seams are made less well defined than in the lower shales. 6. Argillaceous limestone, extremely white in some places and containing the same fossils as layer 4; in the eastern portion of the Range it contains flints; it is often foetid. 7. Chert, hard limestone, weathering rough and pitted; pale yellow or flesh-colour, brittle and

\* Occasionally a bed of white soft fragile limestone is seen to form the base of the nummulitic formation. It is characterized by a *planorbis* which is tolerably abundant; but it contains neither nummulites nor any other fossil. It is found in lenticular beds of little extent, and rarely more than two or three feet thick. It suggests to the mind beds formed in pools or creeks among sandy islands and promontories at the mouth of a river. Whenever it occurs, I have found in the nummulitic limestone above it a great number of teeth and bones of fishes (sharks).



splintery. Shells fewer, nummulites small, but very abundant, especially the *N. variolaria*, whilst the flat and irregular *N. pushi* and *N. lævigata*, so abundant in beds 4 and 6, are not to be found here, or are at least rare. A nummulite about the size of the *N. pushi*, but thicker, is, however, found pretty abundantly, though not in swarms like the *N. variolaria*. A ribbed cardita is the only bivalve which appears tolerably abundant.

67. Resting on the nummulitic formation of the Salt Range are thick beds of Miocene sandstone, clay and conglomerate. I have described in chapter I. how these sandstones form a great plateau between the Salt Range and the foot of the Maree Hill, and indicated that they may be considered as the upper Miocene Bed, whilst the Maree Hills and the whole of the mountains between the Jhælum and the Pir Punjal chain are to be regarded as lower Miocene. The upper bed is rich in mammalian fossils, and is identical to the Sewalik formation. The lower bed is devoid of fossils,\* containing only a few debris of plants, rootlets, small stems and occasionally small nodules of lignite. The upper Miocene has probably been a great deal denuded; remains of the bed are, however, to be seen in the valley of Poonch; they are there rich in very well preserved fossils, teeth of elephants being common and very perfect.

68. The sandstones and conglomerates just mentioned form a great belt from the E. N. E. to the W. S. W. (see Map) and to the north of it appears another belt, having a similar direction and composed of nummulitic limestone and slate. It begins in Hazara in Lat.  $34^{\circ}$ , and forms all the superficial covering of the Hazara mountains as far as the Sirun river and as high north as Mausera, being about thirty miles in width as the crow flies. It proceeds from N. E. to S. W. towards Attock, keeping the same width and extending in that district from the Indus to Janika Serai. Crossing the Indus, it forms the whole of the Akora Kuttuck and Afreedee hills between Peshawur and Kohat, extending about sixteen miles south of Kohat. It has been followed as far as longitude E.  $70^{\circ}$ . The beds of this nummulitic formation have a general dip to the N. W. A similar

\* It is said that one or two bones have been found in the lower Miocene, but this is doubtful; if they exist, they are at any rate very rare. Mr. Medicott has pointed out a non-conformity between the lower and upper Miocene; he makes three beds of the formation.

nummulitic tract follows the foot of the Himalayan ranges along the southern versant of the Pir Punjal chain and its continuation to the S. E. It begins in the valley of Poonch; it is seen north of Rajaori, and the pebbles of the streams near Rajaori are often nummulitic limestone, though the parent-beds have not yet been discovered. I cannot say whether nummulitic beds are to be seen to the north of Tummo, Basaoli, and Noorpoor or in Kangra, but they appear near Subathoo in long.  $77^{\circ}$  lat.  $31^{\circ}$ , and have further been just discovered by Captain G. Austen on the east of the Ganges in Kumaon. But this nummulitic along the foot of the Himalaya is either much denuded or much covered up by Miocene, and does not make such a show on the surface as the other belt which follows the direction of the Afghan mountains.

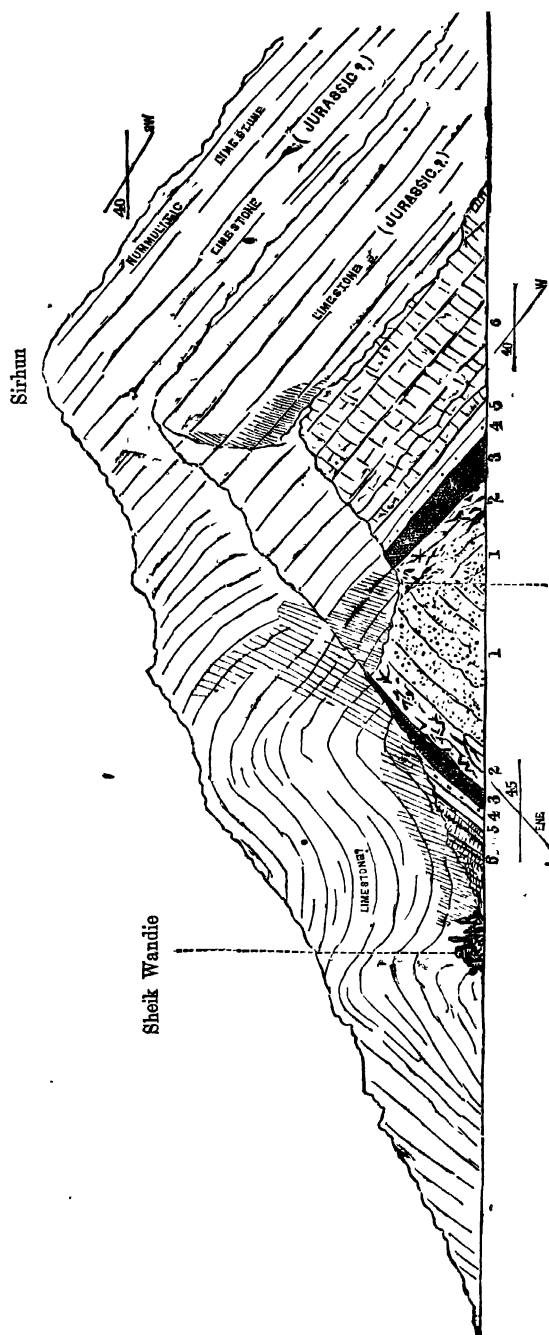
To the north of these zones of nummulite we meet the volcanic hills, which I have described in the first chapter.

69. The stratum of nummulite in Hazara, occasionally broken through, or faulted or denuded sufficiently to allow of older rocks making their appearance.

At the northern end of Mount Sirbun near Abbottabad, carboniferous limestone resting on volcanic rocks is quarried for building purposes. The limestone belongs to the Wecan and Kothair groups and is thin-bedded, arenaceous, marly and occasionally conglomeratic. It is of considerable thickness and immediately covered in by limestone, the lower beds of which are so poor in fossils that it is impossible to identify them, the upper being nummulitic.

The following is a section near the small village of Sheikh Wandie, from E. to W.

(Section VII. of General Map.)



Level of the Abbottabad valley about 4780 ft. above  
the level of the sea.

*Section of the Northern extremity of Mount Sirbun, near Abbottabad,  
from E. to W. bearing S. (not drawn to scale.)*

1. Very compact and very hard Cornean rock, composed of a paste of white feldspar and grey hornstone in intimate combination. The joints and exposed surfaces are smooth and have a quartzzy glimmering. In the paste there is often a partial separation of white feldspar in spots of a dull white colour. Splinters of the white spots can be rounded on their edges before the blow-pipe, but the grey paste of the rock appears to be more refractory, though there is certainly a softening of the mineral compound and a slight smoothing of sharp edges after long exposure to heat. It is a bed of very considerable thickness, stratified and much jointed.

2. White quartzite in a brecciated state, the pieces being recemented together by a grey feldspathose paste. It appears as if the bed had been broken after its formation and the fragments reunited by a feldspathose paste.

3. Very heavy, chocolate-coloured, clay-stone, with bands of quartzite.

4. Indurated clay, with round nodules, the size of a bean, of a black mineral having the lustre of jet, whitening to a milk-white colour before the blow-pipe, and finally melting with difficulty on thin edges; it belongs probably to the hypersthene group. The clay itself is grey, smooth and meagre.

5. Chloritic clay; grey, very smooth and soft to the touch; hardness of slato. It is full of minute round grains of a semi-transparent mineral, grey like the clay, but a little darker. The clay becomes white and meagre before the blow-pipe; it is unaffected by muriatic acid, and does not form a pasty mass with water, either before or after grilling.

6. Limestone, at first extremely arenaceous and argillaceous, and presenting particles of dirty blue and brown colour. It becomes gradually conglomeratic and at the same time thin-bedded, the layers being made of layers of pebbles of limestone cemented by a calcareous sandy cement; the top of the layer appears to have been worn flat by the action of the waves, before the deposit of the next stratum took place, the pebbles appearing as sections on the surface of the bed. The next layer is a muddy limestone containing a few flat *athyris*, remarkable especially for three internal raised lines or ribs proceeding from the beak as far as the middle of the valve. But these shells are in a very bad state of preservation. This layer is only two feet thick, and is succeeded by another equally thin and containing numerous debris of gasteropods and corals. Then comes a black, sometimes blue-black limestone, extremely foetid. The bluer portions are crossed by white lines intersecting each other in all directions and containing only debris of fossils.

The limestone forms altogether a bed of about thirty feet, when it is cut by a fault which causes it to be repeated, and a succession of faults directed W. N. W. to E. S. E. keeps the same limestone on the surface for more than half a mile, it becomes finally covered by nummulitic limestone.

This Mount Sirbun forms the left side of the Abbottabad valley. Following the slopes of this hill, we find beds of quartzite, similar to No. 2 of the above section, reappearing three or four times in short antiforms; above it are beds of limestone containing a few fossils, principally casts of gasteropods. This limestone is often strongly oolitic in structure, but presents also the very unusual appearance of resembling beds of travertine which had been entombed in a calcareous mud after their formation, so that the cavities of the travertine have become filled up with a limestone less hard than the original deposit. I have usually regarded these beds as fresh-water origin near a low coast, and referred them, in a general and provisional way, to the Jurassic; of course this is doubtful.

70. On the lower road from Marree to Abbottabad, near the village of Sayd Kote, great disturbances are observed, and rocks of a geyserian nature make their appearance about half way between Sayd Kote and the Dowr river. They are principally a chocolate-coloured sandstone, becoming coated by weathering on the surface as well as in the joints, with a shining dark incrustation. It is much jointed and breaks in prismatic blocks. A great quantity of dark boulders of this rock may be seen in the bed of the river Dowr. It appears to be similar to some variety of dust-rock or sandy ash or earthy ash seen in Kashmir. It is capped by a bed of quartzite composed of large, opaque, angular grains of quartz, jammed together and cemented by a feldspathic white paste of which there is very little. Angular grains of black augite are sparingly disseminated in the rock. Under the brown sandstone is seen a thick bed of crumbling clay slate, very dark and foliated. This is the lowest bed seen. These three beds, viz., slate, sandstone and quartzite conform together in their dip and are capped by a patchy limestone of doubtful age, and interbedded with grey soft slate. There is much kunkur near the locality.

At Sayd Kote the limestones are wonderfully disturbed: beds having the appearance of Kothair limestone and containing a great number of gasteropods and *cyathophylloides* are seen repeatedly, as the road crosses nearly perpendicular beds which are much faulted. Nummulitic limestone appears to cover in directly the carboniferous (?) beds??

Again on the upper road from Murree to Abbottabad, at the bottom of the ravine under Doonga Gully, volcanic or rather geyserian rocks are to be seen. They consist of a very white and friable rock com-

posed of acicular minute crystals of albite easily fusible before the blow-pipe and pressed and entangled together; there does not appear to be any cement to bind the small crystals together; the rock has a coarsely saccharine aspect and can easily be crumbled between the fingers. It rises in vertical and contorted bands, from half an inch to two and a half feet thick, amongst sands and disintegrated shales. It assumes very many remarkable colours, being sometimes flesh-coloured or reddish, and at other places azure-blue; its general colour is, however, snow-white; where it is blue, the shales near it are of the same colour. It is interbedded with thin beds of tufaceous limestone which have probably found their way there by infiltration. It is covered in by a rubanneous and dark slate, much disturbed, extremely cleaved and jointed and falling into small angular pieces. This slate appears similar to that seen near Syad Kote, and the feldspathose rock is intrusive. These two rocks are at the bottom of the ravine, on a fault, and form a little mound by themselves. There are no rocks to be seen in immediate relation to them, and the beds of the sides of the ravine appear to be entirely nummulitic.

From the examples given of volcanic rocks in Hazara, it seems evident that that district has participated in the great volcanic accumulation which preceded the carboniferous epoch, and that it has also been disturbed at a later date by intrusive volcanic action of a local and geyserian character.

71. Of Chumba, Kulu and Kunawar, districts which occupy the hilly tracts south of the extension of the Pir Punjal chain towards the Sutlej, I know nothing.

72. Kashmir is continued to the south-east by the highlands of Lahul and Spiti which are situated in the same Himalayan parallel, viz., between the Pir Punjal chain or parallel and that of the Ser and Mer. Spiti has been pretty often visited by geologists, and we know that carboniferous and Jurassic fossils were brought thence by Dr. Gerard. Liassic fossils have also been found there. As for crystalline rocks, M. Marcadieu mentions much granite, and Captain W. E. Hay, granite penetrated by huge veins of ter-sulphuret of antimony and "other metals." Gypsum is reported as extremely abundant in Spiti, forming, it is said, whole mountains; and here I

would mention again that several hot springs are found in close vicinity to these gypseous beds.

But I must draw back here, and leave the ground to Dr. Stoliczka who has been for some time studying the geology of Spiti with great care and is preparing a work on the subject. Dr. Stoliczka has found in Spiti rocks of the following ages: Silurian, Carboniferous, Triassic (?), Liassic, Oolitic and Cretaceous. I have said before that most of the fossils from Spiti represented in Dr. Royle's Illustrations, are to be found in the Jurassic rocks of Sheikh Bodeen.

73. The great chain of Ser and Mer (called by Capt. R. Strachey, between the Sulej and the Kali, the chain of Snowy Peaks, and by Cunningham, the western Himalaya or central chain of the Himalaya) appears to be, as far as I have been able to ascertain, made up of granite, gneiss, and other rocks of the plutonic and metamorphic groups. From the Nanga Parbat (26,629 ft.) to near the Sojji La pass, (11,300 ft.) the range is, I believe, mostly granite; it is traversed by the road of Skardo via Guzais, and Mr. Drew informs me that the range, (which here forms the southern boundary of the Deosai plain) is "chiefly granite, partly schist." The plain of Deosai is a singular plain or steppe entirely covered with debris and loose stones; it is tolerably flat, considering how it is situated, and has perhaps once been the bed of a gigantic glacier. It is surrounded by granitic mountains on the southern and western sides; the north end is bounded by mountains of schist and slate, and the eastern side is closed in by granitic hills which gradually pass, over Drass and Kurgyl, into volcanic rocks.

If we cross the Ser and Mer chain by the Sojji La, from Kashmir into Drass, we find near Baltal, a village on the Kashmir versant of the pass, that the carboniferous limestone ceases and is succeeded by beds of very coarse and micaceous slaty shales, often very sandy and always very thin-bedded. The specimens I possess of this rock show it to be identical with the sandstone and sandy coarse shales seen in the Zebawan and there interbedded with ash, agglomerate and slate. This rock goes on to nearly the top of the pass, where it becomes a dark and hard slate, having a metamorphic appearance. Then limestone reappears and is seen as far as Drass; it rests the whole way, as far as can be seen, on volcanic rocks and azoic slate. It is pro

bably continuous, through Sooroo, with beds of limestone seen between Moolbek and Khurbu.

\* I do not know what sort of rock forms the summit of the Kun Non or Ser and Mer Peaks (23,407 ft.) but their north-eastern slope and spurs are composed of gneiss and schist; these metamorphic rocks extend as far as the Sojji La, where they are graduating into beds of the coarse slaty shales described above; on the north of the road it is continued by beds of slate and of sandstone extremely micaceous and resting on mica-schists, of which some specimens effervesce powerfully with acids. Beds of metamorphic white marble are also seen, but the great bulk of the mountains between Tillail and the Deosai is made up of granite, shist and mica-slate.

Following the great chain to the S. E. we find it crossed by several passes of which the Bara Lacha (16,505 ft.) and the Parung la (18,794 ft.) are the most celebrated and frequented. Mr. Marcadieu describes these passes as being principally through granitic rocks; but unfortunately Mr. Marcadieu does not seem to have enjoyed much his visit to these "*belles horreurs*" and he gives us little geological information, but many complaints, about these "delights of Satan," as he calls the mountains.

South-east of the Sutlej, the chain continues to be mostly granitic. It is studded with noble peaks, Porgyul (22,700, ft.) Baldang (21,400 ft.) Kamet (25,000) and Nanda Devi (25,700, ft.) all of them made up of granite, gneiss, and schist. But I must refer the reader to Captain R. Strachey's paper "on the geology of part of the Himalaya mountains,"\* for the mountains south-east of the Sutlej.

74. Having crossed the Ser and Mer Parallel, we find ourselves in the great trough between this chain and that of the Kailas peak (which I shall call for convenience sake the Kailas chain) and we may hardly call this trough a valley, considering that it is a plateau from 10 to 12,000 feet high above the level of the sea; and yet it is a valley between the two great parallels which tower over it by some 10,000 feet more. It comprises the districts of Deosai, Soroo and Drass, Ladak proper, Zanskar, Rukshu and in the S. E. the great plateau of Tibet through which runs the Sutlej and inhabited by the Hundes. This last or south-eastern portion of the trough is toler-

\* Proceedings of the Geological Society of London, June, 1851.



ably flat, only a small volcanic peak rising here and there, detached and isolated, through the thick horizontal bone-beds of sandstone and conglomerate which fill up the valley.\* But in the other districts, the trough is nearly entirely filled up by vast mountains, which occupy in the parallel valley of Ladak the same position as the catenated chains we have described in Kashmir do in the parallel valley of Kashmir; the chain formed by these mountains has been called by Colonel Cunningham the "Tso Moreri" chain, and has been raised to the position of one of the great parallel chains of the Himalaya, but it will best suit our purpose to consider it as an inter-parallel mass of mountains.

Deosai has been described already. Drass and Kurgyl are covered with volcanic rocks into which the granite of Deosai gradually passes. Mr. Drew tells me that he found near Kurgyl a rock composed exclusively of mica and felspar, graduating into granite. Some specimens I possess from Tashgam, half way between Drass and Kurgyl, are composed of a dark green hornblende which fuses with difficulty and swelling a little before the blow-pipe. Felspar is not conspicuous, but is probably intimately combined with the hornblende. But rocks undoubtedly volcanic are also seen, such as greenstone and amygdaloid. A considerable bed of limestone reposes on the volcanic rocks and appears to be the continuation of the bed seen near Drass. I do not know the age of this limestone. The Drass bed contains fossils which are, I believe, carboniferous, and I have coloured the bed now under consideration, carboniferous, assuming the continuity of the two beds to be true.

Of the mass of hills traversed by the road from Kurgyl to Le I know very little indeed. They are said to consist mostly of slaty rocks capped here and there by conglomerates and grits.

As we near the valley of the Indus in Ladak proper, near the village Kulsi, interesting beds appear. Resting on a hornblende rock or trap is a series of slate, light coloured limestone, conglomerate with rolled boulders of the same limestone, sandstone, shales and dark purple indicated clays. The dip is not very great and the several beds appear to conform together. The whole valley of the

\* Proceedings of the Geological Society of London, page 306.

Upper Indus from Kulsī to Nodmo (and probably further east) appears to be excavated in this formation and the river flows in a fault of it or more probably in the centre of a denuded anticlinal.\* The series of rocks (series of Upper Indus Valley) rest, on the North, against the granite of the Kilas Range. Captain G. Austen, to whom I owe these details, estimates it to be at least 3,000 feet thick, and mentions also its appearance in Rodok at the North of the Pang Kong Cho, resting there unconformably on slate. In the limestone layer of this series (about 150 feet thick or more) Captain Austen found a few fossils which he was kind enough to show me. They were very ill-preserved and fragmentary, but appeared to resemble some forms found in the Kothair bed in Kashmir; some cyathophyllides are certainly not to be distinguished from those represented at figures 56 and 57, Plate VII. Another fossil was supposed to be the radical end of a Calamite. To complicate matters, the fossils were declared by palæontologists at home to be *cretaceous*. The specimens are so bad, that I apprehend that this determination must have rested entirely on the *one* fossil which I took for a Calamite, and which was regarded, I suppose, as a Hippurite. My own impression is, that the limestone is identical with the Kothair bed of Kashmir, and therefore either the uppermost layer of the carboniferous or perhaps the lowest of the Triassic.

Above this Upper Indus series come the nearly horizontal grits and coarse sandstones which form the flats called in Ladak Chang Tang and Rang. The non-conformity between the Indus Series and the Chang Tang beds is not conspicuous, as that dips at a very low angle and these are nearly horizontal. There is also, I believe, a great similarity of lithological character between the two formations, one being merely the resettlement of the other. I conceive that some difficulty may be experienced occasionally to decide where one formation ends and the other begins. A few mammalian bones have been found in the Chang-tang sandstone, and there is but little doubt that this bed is similar to the sandstone and conglomerate of the Great Thibet plateau to the north of the Niti Pass. These high horizontal plateaux of conglomerate and sandstone are also observed

\* A very great number of rivers in the Himalaya run part of their course in the centre of a denuded anticlinal.

in the Afghan mountains, where they are called in Pooshtoo Ragzhie. I have examined some of these ragzhies, of which the plateau of Rushmuk in Waziristan is a good example at an elevation of 7,000 feet, and I feel satisfied of their fluvio-lacustrine origin and of their age being posterior to the final upheaval of the Himalaya and Afghan mountains.\*

Zaskar and Rukshu or Rupshu are interesting districts, on account of their lakes, numerous hot springs and borax mines. The country is an elevated labyrinth of mountains and valleys, having a mean height of 15,600 feet. The principal peaks are the Korsok Too (above 20,000 feet) and the Napko Goundo ; but there are great many other nameless peaks ; the passes are all a good deal above 17,000 feet. In Zaskar we find a great mass of gneiss and schist which appears to be the eastern extension of similar rocks which begin in Sürü, and, after entering largely in the formation of the mountains of the highland of Zaskar, are prolonged eastward into Rukshu, where they graduate into beds of metamorphic slate on which rest fossiliferous rocks. The gneiss, schist, slate and limestone are all stratified and conformable together, and they all dip towards the S. S. W. The limestone appears to be the continuation of the bed of limestone seen in Sürü reposing on the gneiss and schist of the foot of the Ser and Mer peaks.

The occurrence of fossils in Rukshu had been noticed by several travellers, but little was satisfactorily known, and to Captain G. Austen is therefore due the credit of having first brought trustworthy fossils from Rukshu, and to him I am indebted for the following details :—

Two of the valleys of Rukshu are the Tso Moreri valley and the Pang-po-loomba ; they are separated one from the other by the ridge of the Korsok Tso, composed of granitoid rocks and of gneiss and schist. From the Pang-po-loomba (valley) one passes into the valley of the Tsa Rup (river) by the Pang-po-la (pass), towards Zaskar. This Pang-po-loomba (valley) and Pang-po-la (pass) are the localities where fossiliferous beds have been noticed. The

\* Col. R. Strachey appears inclined to regard these horizontal beds of the Great Thibet plateau as contemporary of the Siwalik hills and a sea-formation. I believe that both hypotheses are untenable.

whole bottom of the valley is uneven and its southern portion is formed by beds of limestone in which both Captain Austen and Mr. Marcadieu found carboniferous fossils (No. 1.) At the foot of the Pang-po-la the carboniferous becomes covered by a muddy sandstone (No. 2) which is, however, not seen in situ on the northern slope of



Section across the Pang-po-loomba (valley) and Pang-po-la (pass) in Rakshu from a sketch by Captain Godwin Austen (approximate).

the Pang Po, but of which numerous debris fill the ravines. Above this sandstone is found Jurassic limestone (No. 3), all the way to the top of the pass, full of *Belemnites*, *Ammonites*, *Rhynchonellæ* and *Terebratulæ*. One of the *Rhynchonellæ* collected there by Captain Austen appears identical with a form very common in the middle Oolite of Sheikh Bodeen in the Punjab.

Having crossed the top of the pass and descending towards the Tsa Rup (river), the same bed of muddy sandstone (apparently) again crops out. It is there interbedded with thin beds of impure limestone, and in these beds were discovered a great many *Belemnites* in fine state of preservation. Mr. R. A. C. Austen, to whom the fossils of these parts were forwarded, pronounced some of them to be *Liassic*, but I do not know whether these liassic forms came from the muddy sandstone bed or from beds inferior to it.

On the other side of the valley of the Tsa Rup, some beds of limestone, much folded and bent, again appear, but they showed no fossils and their age is therefore unknown; they rest against beds of slate much up-tilted and apparently unconformable to the limestone. At the back of the slate is the great mass of the Ser and Mer chain, attaining immense height and crossed by passes above 16,500 feet high.

75. The Tso Moreri is the largest of many salt lakes which form one of the features of Rukshu. It is 14 miles long and more than 15,000 feet above the sea. Its water is very salt and bitter, though Mr. Marcadieu affirms that it contains only one part of saline matter

in 10,000 parts of water ; the saline matter is sulphate of soda and sulphate of lime. Another lake, the Karso-Talao, about 6 miles long, is reported by the same gentleman to contain a great deal of chloride of sodium and sulphate of soda, with a little carbonate of lime and carbonate of soda. These two lakes are said to be surrounded by mountains of crystalline rocks, principally mica-schists and granite. But one of the most interesting subjects connected with the geology of Rukshu is the existence of borax in the valley of Puga. The manner in which it occurs as an efflorescence is too well known to require description here, but one cannot but regret that Mr. Marcadien's report is not more geological ; indeed it can only be regarded as chemical, and the geology of the district is still a work to be done. I have never visited Puga, but, from the several descriptions of it I have read, I am satisfied that the borax ground is the bottom of a dried up lake. The analysis of impure borax collected at Puga shows it to contain, besides borax, sulphate of soda, sulphate of lime, chloride of sodium and carbonate of soda. These impurities are precisely the composition of the Kullur salt of the plains of the Punjab and of the saline matter of many hot springs and salt lakes of the Himalaya and the Salt Range, and it appears to me evident enough that the lacustrine mud which fills up the bottom of the Puga valley, is similar to the alluvial deposit of the Punjab. Boracic acid, which probably once rose freely to the surface of a small lake and was deposited in an uncombined state, is now arrested by the bed of lacustrine mud which fills up the fumarole and combines with some of the salts of soda. It appears therefore much to be regretted that an attempt was not made to estimate the thickness of the lacustrine deposit and that a few wells were not sunk into the borax ground and the waters and gases which might have been collected in these wells carefully examined ; possibly such researches and experiments might have led the way to an increase of the present supply, and to a system of collecting the borax or boracic acid sufficiently pure not to require refining.

76. In Ladak, Rukshu, Sooroo and Zaskar, no fossils were ever found, as far as I know, older than those of the carboniferous formation. But if we follow the great valley, between the Kailas Range and the Ser and Mer chain towards the S. E. we find, on the other

side of the Sutlej, great beds of limestone rich in Silurian fossils.\* Mr. Salter has recognized the following genera among Captain Strachey's fossils :—

|            |              |               |                    |
|------------|--------------|---------------|--------------------|
| Cheirúrus. | Strophomena. | Cyrtoceras.   | Choetetes.         |
| Lichas.    | Orthis.      | Litnites.     | Crinoid Stems, &c. |
| Asaphus.   | Leptæna.     | Tentaculites. |                    |
| Calymène.  | Lingula.     | Murchisonia.  |                    |
| Ilkenus.   | Orthoceras.  | Ptilodictya.  |                    |

Mr. Salter, M. Barrande and M. de Verneuil, who saw some of the fossils collected by Colonel Strachey, agree that they indicate beds of Lower Silurian. We shall see that beds of Silurian also exists in the huge mountains to the north of Skardo and near the Mustak Pass in the Korakoram chain.

But let us first relate what Colonel R. Strachey found in the high ranges south of the Sutlej.

The Silurian above mentioned rests on beds of slate without fossils, and this slate rests on schists, mica-schists and other rocks of the metamorphic group. Then above the Silurian limestone, some beds of carboniferous must exist, though they were not found in situ by the explorer; *Producti*, *Athyris Royssii* and other well known fossils were found in loose boulders near the Niti Pass. I believe also that some of the shells placed by Colonel Strachey and Mr. Salter in other groups belong really to the carboniferous; such is the *Chonetes* placed by Colonel Strachey in the Mshelkalk, but transferred to the carboniferous by Mr. Salter; the *Ptilodictya Fenea* (Salter), the narrow variety, which I have found in carboniferous beds in Kashmir; (it was naturally placed with the Silurian fossils by Mr Salter, on account of the *Ptilodictya* having been found as yet only in Silurian beds in Europe and America); the *Spirifer Stracheyi*, (Salter) placed among the Triassic fossils by Mr. Salter, and which is common enough in the Weean bed of carboniferous limestone in Kashmir; and lastly the *Spirifer Rajah* (*Spir. Keilhavi*,

\* On the geology of part of the Himalaya and Tibet, by Capt. R. Strachey, Bengal Engineers, F. G. S. in Proceedings Geological Society for June 1851, also "Palæontology of Niti in the Northern Himalaya, being descriptions and figures of the Palæozoi and Secondary fossils collected by Colonel R. Strachey B. E." "Descriptions by T. W. Salter, F. G. S., A. L. S. and H. T. Blanford, A. R. S. M., F. G. S.—Calcutta 1865."

Von Buch), which has been removed from the Trias by Dr. Oldham, and declared to belong to beds anterior to that epoch.

There is therefore a strong probability that both the Zeeawan bed (*Productus semireticulatus*, *Athyris Royssii* &c.) and the Weean bed (*Spir. f. Stracheyii*, *Spir. Keilhavii*) exist in the ranges near the Niti Pass, but have been much denuded and broken in loose fragments along the section followed by Colonel R. Strachey.

Then comes what Colonel Strachey supposed to be Muschelkalk, and which Mr. Salter refers to the Kenper and Hallstadt bed of the Upper Trias. I cannot refrain from expressing a suspicion that a few of the shells referred to these beds do not really belong to them, and that fossils of various ages have been mixed, either from collecting them, without due care being paid to the strata in which they were respectively found, or from careless packing. There is such a great likeness between the figures of some of the Triassic Ammonites of Mr. Salter and those of the carboniferous ceratites of M. DeKoninck,\* (see *Ammonites Blanfordii*, Salter, nov. sp. and *Ceratites Lyellianus*, Dekon. nov. sp.) that one finds it difficult to decide between these two great authorities. The species of ammonites figured in the Palæontology of Niti have nearly all the ceratite-like sutures usual in triassic ammonites in Europe, and therefore much resemble deKoninck's ceratites.

It may be advanced, on the other side, that M. DeKoninck's ceratites belong to triassic beds; but these ceratites are to be seen in the Rotta Roh associated to some of the fossils which I have given as characteristic of my Weean bed of the carboniferous in Kashmir and the Punjab; and a portion at least of this Weean bed would have then to be made over to the Trias. Unfortunately for this view, the mixture of Weean and Zeeawan fossils in some layers of the Rottah Roh (described in para. 60<sup>e</sup> of this paper), does not allow us to make the Weean anything but carboniferous, unless we are prepared to regard the *Prod. semi-reticulatus*, the *A. Royssii*, the *A. Sabtilita* and other such essentially

\* "Description of some fossils from India, discovered by Dr. A. Fleming, of Edinburgh." By Dr. L. de Koninck, F. M. C. S., Professor of Chemistry and Geology in the University of Liège—Journal Geological Society of London, Vol. XIX. p. 1.

carboniferous fossils as occasional inhabitants of the Trias!!! If we are prepared to stretch the point so far, we may as well give up at once all idea of successive faunæ.

I have, since writing the above, found in the Rottah Roh, some beds containing a few fossils which appear Permian. I have not yet had time to examine the fossils with care; but should they prove Permian or Saliferian (St. Cassian),—and I have little doubt that they will be found to belong to either one or the other of these formations,—the presence of patches of such a bed on the top of the carboniferous would explain away, in a great measure, the difficulties I have now been considering.

I have said before that I believe the Saliferian of Upper India to belong to the Paikilitic formation, but that it has been found impossible as yet to *demonstrate* that such is the case. The discovery of one or two fossils may settle the question, if they were forms thoroughly well known as characteristic of the Indian Trias. The study of the fossiliferous Triassic beds in India is therefore of the greatest interest; but much care is required lest the mixture of Palæozoic and secondary types should take place in our packing boxes and not in nature, and we thus become accustomed to regard, as characteristic of the Trias, shells which really belong either to the carboniferous, or to the Lias and Oolite.

To Colonel R. Strachey, however, is due the honor of having first discovered fossiliferous Triassic beds in the Himalaya; and we may hope that much light will be thrown on the Indian fossils of that age by Dr. Stoliczka, in his expected work on the Geology of Spiti.

Over the beds last described, Colonel Strachey found Jurassic beds; but the relation between the Triassic and Jurassic beds could not be ascertained, owing to a great fault running parallel to the general N. W.—S. E. direction of the Himalayan ranges. The section exposed by this great fault is at least 5,000 or 6,000 feet in thickness, but the difficulties of the route prevented Colonel Strachey from examining it from top to bottom; the lowest beds were not examined. The *lowest which were examined* gave forms which Professor E. Forbes was inclined to identify with fossils which occur in the fuller's earth and cornbrash of England. No Liassic forms were discovered.



These inferior oolitic beds are capped by dark coloured shales containing belemnites and ammonites, and referred by Professor E. Forbes to the age of the Oxford clay. These shales are therefore the representatives of the several Jurassic beds we have already seen in several parts of the Himalaya and of the Punjab.

The oolitic beds are covered by grits, shales and limestone of unknown age, and finally by the great horizontal bed of what Colonel Strachey considers to be miocene (Siwalik) sandstones and conglomerates. I have said before that the identity of these sandstones, grits and conglomerates to the Siwalik formation is far from established, and that there are more reasons for considering them pleistocene, than for assuming them to be coeval with the deposition of the Sub-Himalayan tertiaries.

77. The Kilas Chain is of less elevation than the Ser and Mer, and its peaks are neither so numerous, nor so well known or so remarkable for their enormous mantles of snow. The principal summit is the Kailas (or Tise) peak, which rises to 22,000 feet above the sea, in longitude  $81^{\circ} 18'$ , and is therefore far to the S. E. of our Western Himalaya. As it is, however, the only well known peak of the Chain, I have called the whole chain from its name.

The Kilas chain begins near Mount Haramash, N. of Astor and N. W. of Baltistan, and is traversed near Skardo by the Shigar river which cuts a passage across the range. The summit, Mashkulla, (16,919) towers over the alluvial plain of Skardo, Shigar and Kuardo. This mountain is mostly granite; its spurs show a great deal of metamorphic slate at a high angle of dip; and the little hill close to Skardo, evidently an off-shoot of the Mashkulla, is composed of an imperfect schist. All along the left bank of the Shigar river, schists of various sorts, especially mica-schists, and micaceous slates, together with metamorphic marbles, form the great wall of mountains that bound the Shigar valley to the N. E. Following the road which leads from Shigar to the Thale valley, by the Thalé la (pass) Captain G. Austen discovered some beds of limestone, resting on the mica-slate, and I have coloured that bed of limestone Silurian in the Map. My reason for believing it to be Silurian is its proximity to limestone beds of similar appearance and position at the Mashabroom, and there, I believe, decidedly Silurian; and also the fact that the

discoverer of the bed found there a few fragments of fossils which he regarded as Palæozoic, though different from any of the carboniferous forms which we found together in Kashmir. There is therefore presumption that this bed is Silurian, though of course it is merely a presumption. I have also assumed that a bed of limestone, seen to the South of Skardo, between that town and the Deosai (plain), is Silurian. We shall see the bed discovered at the Mashabroom, when we describe the Karakoram Chain.

- From Skardo towards the S. E., the Kilas Chain appears to be nothing but a great granitic wall, along the foot of which runs the Indus. Near Lé in Ladak the range is crossed by the Digor La (pass), the road going through a succession of granitic rocks.

78. Between the Kilas and Karakoram Chains, we find the rugged district of northern Baltistan, the valleys of Saltoro, Nubra Shayokh and the Chinese province of Rodok. In the country of the Baltis, the Kilas and Korakoram Chains approach each other to within about 45 miles, as the crow flies, from range to range; whilst on the contrary the chains diverge as we proceed towards the S. E., the Korakoram chain having apparently a less southward direction than the other parallels of the Himalaya. In northern Baltistan, consequently, we find the country covered with mountains, cut with deep narrow valleys and mantled with immense glaciers;\* in Radok on the contrary high plateaux are abundant, and form to the north of the Pang Chong Tso (lake) and Pang Chong La (pass) considerable plains, 14,000 to 15,000 feet above the sea, arid and rainless, often not presenting a shrub for several marches; high deserts on which roam a thin population of nomade Turkomans who graze shawl-wool goats on the scarce and far-between Aghil or grassy vales of these inhospitable regions.

There is no doubt that these high plateaux are similar in origin, age, and appearance to the great Thibet plateau through which runs the Sutlej, to the north of the Niti pass; and described by Colonel R. Strachey; and also to the Chang Tang and Rong plateaux of Ladak. All these high plateaux present a horizontal stratification;

\* "On the Glaciers of the Mustakh Range," by Captain H. G. Austen, F. R. G. S., &c., read before the Royal Geographical Society, London, on the 11th January, 1864.

and it appears therefore impossible to regard them otherwise than as accumulations of debris washed from the ranges into the great troughs between these ranges, and therefore posterior to the great final upheaval of the Himalayas.

Very little is known of the nature of the rocks forming the ridges, ranges and spurs in Saltoro, Nuha and Shayokh. Dr. Thomson,\* on native information (Izzet Ullah), tells us that the rocks of the Shayokh and Nuha valleys are in great part primitive limestone. "The limestone continues towards Rodok and the water of the Pang Gong Tso (lake) hold a sufficient quantity of lime to form a calcareous deposit which cements the pebbles together in patches of concrete at the bottom of the lake." The water of the Pang Chong Tso is sufficiently brackish not to be fit for drink, and it has a bitterness probably due to sulphates of Soda and of Magnesia. From the examination of a specimen of the calcareous incrustation which is formed on the shore of the lake, I found that Magnesia is about as abundant as lime.

An extremely pretty species of *Limnea* or rather *Physa* once lived in the lake, and dead shells of it are abundantly found in the band of tufaceous deposit, a few feet above the present level of the water. These shells no longer exist in the lake (Austen). They have probably been destroyed by the diminution and concentration of the brackish water.

General Cunningham informs us† that the rocks of all the high ranges and peaks of Rodok are granite and gneiss, and this appears to be highly probable. Metamorphic rocks also abound; the mountains near the Pang Chong Tso containing a great deal of mica-schists; and crystalline marble is also found on the shore of the lake, apparently in immediate contact with granitoid rocks.

In the northern portion of Rodok some hot springs exist in a locality called Chong Chin Mo; there water deposits largely a grey tufa which is composed of carbonate of lime, sulphate of lime and sulphate of soda. Such tufa is common near the warm springs of the saliferian in the Punjab. Its composition is also that of the saline impurities of the brackish lake of Tso Moreri in Rukshu, and

\* "*Ladak*," by General Cunningham, R. E.

† "*Ladak*," by General Cunningham, R. E.

of the efflorescence which accompanies the borax at Puga. From the extensive beds of gypsum and impure salt found in Rukshu, little doubt can be entertained that the saliferian is there well developed, and by analogy it is to be presumed that the same formation is also to be seen in Rodok. Borax is said to be exported from Rodok in large clean crystals, but I do not know whence they are obtained; that it does come from Rodok appears however pretty certain; and that is another resemblance with Rukshu, and another reason for believing that the saliferian is probably well developed in Rodok, and is there accompanied by hot springs and fumaroles exhaling boracic acid.

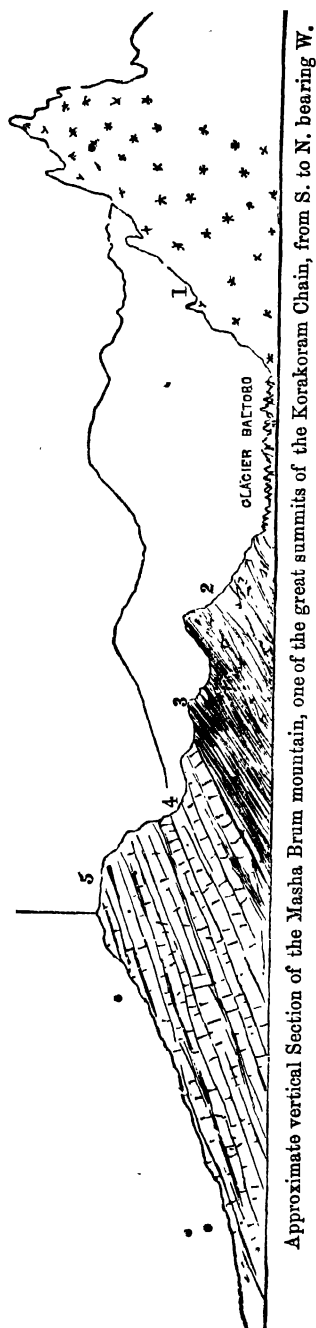
I have never seen any fossil which had been brought from Rodok, Shayokh or Nuba; it is impossible therefore to say to what age belong the beds of limestone mentioned by Dr. Thomson. The beds are called "primitive limestone;" but as Jacquemont, Vigne, Thomson and others speak sometimes of fossiliferous limestone (such as the Manus Bal limestone in Kashmir) as "primitive," it is difficult to know for certain what is meant by that somewhat antiquated term.

79. The Korakoram Chain is a range of very great extent, beginning at the Pamer Steppes and reaching to the S. E. as far as the centre of Thibet in longitude E.  $94^{\circ}$  and as low as latitude N.  $30^{\circ}$ . The plateau near its south-western slope is from 15,000 to 17,000 feet high, and is an arid tract of horizontal alluvian covered with loose stones and supporting very little vegetation; more to the north it is a labyrinth of wild valleys. Near the Mashabroom mountain (above 26,000 feet) the soil of the valleys between the spurs is to a great extent covered by glaciers; where not so covered, it is often an indurated clay strewed with debris of pale limestone a good deal worn and weathered, and with globular cystideæ in very great abundance. Mr. Ryall, of the Great Trigonometrical Survey, gave me one of the pieces of limestone and some of the fossils. The limestone is an argillaceous dolomitic limestone, pale yellowish brown, with a few patches pale blue, weathering like frosted glass, and resembling a good deal of the rocks of the Wecan and Kothair groups of carboniferous limestone. The *sphæronites*, however, point to a silurian epoch, these echinoderms having not been found as yet in formations posterior to the Wenlock limestone.

The *sphæronites* of the Mashabroom are probably a new species ; they were found in considerable variety, from the size of a small walnut to that of a large orange ; the largest were perfectly round and polished like a cricket ball, without warts, spines or facettes, pierced by numerous pores. Some of the smaller have the stems scarcely visible (fig. 6, Pl. VIII), and are covered either with large tracts set well apart or with smaller ones set closer ; some spines\* are depressed or lenticular ; all are pierced by innumerable pores, none shows traces of polygonal plates ; mouth not to be seen in any of the specimens I have examined. (See figs. 5, and 6, pl. VIII and plate IX fig. 1.) The discoverer, not being a geologist, did not look for other fossils : the cystidæ were so numerous and so curious in appearance, that they gave quite a peculiar aspect to the ground.

The Mashabroom is stratified to its very summit, the beds being limestone and shales, dipping towards the S., at a moderate angle. This stratification is so well marked, that it can be distinctly noticed from a long way off. These sedimentary beds repose on metamorphic layers of mica-schist and gneiss. The limestone is extremely rich in magnesia, principally towards the base of the bed, where it passes into Steatite in patches (Austen). Some of the Serpentine and Jade (compact Tremolite) brought to Srinuggur and there worked into ornamental articles by the stone-cutters of that city, come, I believe, from the neighbourhood of the Mustak Range and of Mashabroom, though the greater quantity is supposed to be derived from the Yarkandkass valley and the Kuen-Luen Chain in Khotan. There can be little doubt that the limestone of the Mashabroom is the parent bed of the cystidæ found in the valley between two of the spurs of that mountain ; and at least a portion of the limestone of Mashabroom is Silurian.

The following sketch-section embodies the information kindly given me by Mr. Ryall and Captain G. Austen.



1, granite; 2, gneiss and mica-schist; 3, sandy shales and coarse slate without fossils; 4, pale dolomitic limestone containing patches of Steatite; 5, pale ochre-coloured limestone, the probable parent rock of the Sphæronites found at the foot of the mountain.

To the north of the great glacier Baltoro is that portion of the Korakoram Range known as the Mustakh and crossed by the Mustakh Pass at an elevation of 18,400 feet. The whole S. Western face of this Mustakh is covered by enormous glaciers through which the rocky spurs of the mountains rise like islands and promontories. These rocks Captain Godwin-Austen found to be limestone dipping to the N. E., but he failed to find fossils in it, though he noticed traces and fragments of organisms. It is so very probable that these beds are a continuation of the limestone of the Masha Brum, that I have not hesitated to colour them in the map as Silurian. Of course, this requires confirmation. Unfortunately the difficulties of reaching even the foot of these gigantic mountains are nearly insurmountable.

80. I could not get any information on the nature of the rocks forming the remainder of the Korakoram Chain. The few European travellers who ever saw the chain, agree, I believe, in representing it as being mostly composed of granite.

On the other side of the chain we find, between it and the next parallel, *viz.* the Kuen-Luen Chain, the valley of the Yarkandkash (river), which extends from the Korakoram or Yarkand pass to Tashgurkhan, and the Akzai Chin or White Desert, which is continued towards the S. E., nobody knows how far. The valley of the Yarkand river and the Akzai Chin are separated one from the other by a low ridge of mountains similar to the masses of mountains found between the other great chains of the Himalaya. All we know of the valley of the Yarkandkash is that some mines of rock-salt occur there, and that both in the beds of the Yarkandkash and Karakash and in the ravines of the neighbourhood, some pebbles are collected and used for cheap jewellery; and these pebbles are either quartz stones or rocks decidedly volcanic. There is apparently some analogy between these mountains and those of the centre of Rupshu and of Ladak. The Akzai plain is also very similar to the countries just mentioned, in at least the one character of being an elevated, rainless desert, spotted with small lakes, some fresh, and others salt.

It is superfluous to say that I know nothing of the Geology of the Yarkandkash and Karakash valleys and of the Aksai Chin; neither is there anything known of the formation of the Kuen Luen or Piriyukh Chain, except that it is reported to contain valuable copper and gold mines. Another small chain or range, half way between the Kuen Luen and Yarkand seems to be the last parallel of the Himalaya. Yarkand is supposed to be in latitude N.  $38^{\circ}$  and about 5000 feet above the sea. From the top of the Korakoram pass to the foot of the hills, the distance is approximately 110 miles, and the descent 13,000 feet or about 118 feet per mile, a mild slope for a mountainous country.

*(To be continued.)*

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*Contributions to Indian Malacology, No. VIII. . List of Estuary shells collected in the delta of the IRAWADY, in PEGU, with descriptions of the new species. By WILLIAM T. BLANFORD, A. R. S. M., F. G. S., Gor. Mem. Z. S. &c.*

[Received 14th November, 1866.]

A short visit to Calcutta, and access to various works on conchology which have, for some years past, been beyond my reach, have enabled me to prepare the following list of the species of mollusca collected by me in the Pegu delta during the early portion of 1862. In March and April of that year, whilst engaged in the Geological Survey of the country south of Bassein, I was compelled to traverse the network of creeks which intersect the Irawaddy delta in every direction, and, in so doing, I had many opportunities of searching for the various mollusca inhabiting the channels of brackish and salt water.

The western portion of the Irawady delta south of Bassein is of peculiar character. Instead of the endless alluvial flat which is usually alone met with near the mouth of large rivers, the country is frequently undulating, and even, in places, hilly; the hills being surrounded by plains of alluvial soil intersected by tidal channels. Rock not unfrequently occurs in these creeks, and affords a habitat for many mollusca which are not met with in the usual muddy flats.

The Bassein river itself, one of the numerous mouths of the Irawady, like the Mutlah and other great channels of the Ganges delta, is at present rather an arm of the sea than a river; as it receives no fresh water directly from the Irawady except during the height of the rains. In the cold weather the water is perfectly salt for many miles above the mouth, and marine animals abound. Thus for many days, during the time I was traversing the neighbourhood, the water swarmed with *Medusæ*. The volume of fresh water which pours into the Bassein river can at no time be very large, for the mollusca which inhabit the southern side of Negrais Island, some distance within the mouth of the river, are typically marine, comprising species of *Parmophorus*, *Triforis*, *Trochus*, *Chama*, &c., and not including any of the usual estuary forms *Assiminia*, *Amphibola*, *Neritina*, &c., whilst at Poorian Point and Pagoda Point, the two headlands which form



the entrance to the Bassein river, precisely the same mollusca occur as along the Arakan coast near Cape Negrais.\* At the mouths of those channels by which the mass of fresh water poured down by the Irawady reaches the sea, I do not think that any typically marine animals are met with, nor could they exist, for, in the height of the rains, I have found the water outside the mouth of the Rangoon river perfectly fresh and drinkable, and yet this is only a minor channel compared to the Chinabuckeer and the neighbouring branches, down which the great bulk of the water pours.

To the greater saltness of the Bassein river I attribute the presence of the numerous marine types mentioned in the following list. It will be seen that a few distinctly marine species were met with; the number, however, was small. There are also in the list two or three genera, forms of which do not appear to have been hitherto found in estuaries, *e. g.* *Tectura*, *Sphenia*, *Scaluria*; whilst, on the other hand, the genus *Scaphula* had previously only been met with in fresh water.

The fauna and flora of the Irawady delta appear to be twofold.† Farther from the sea, where the water is more or less brackish, the creeks are mostly narrow and deep, with steep banks, which are covered at high water, and bordered by an unbroken belt of salt swamp, in which grow high trees, chiefly of *Bruguiera gymnorhiza*? The views along the creeks, with their borders of dense high forest, are often of great beauty. This belt of salt swamp and high trees varies much in breadth, from a few yards to half a mile or more; inside it are either open plains, which, if uncultivated, are covered with high grass, or else rises, usually of gravel, occasionally of rock, which are covered with jungle.

The mollusks of this tract comprise *Neritina depressa*, *N. obtusa* and *N. Smithii*; the species of *Tectura*, *Modiola*, *Martesia* and *Sphenia* named in the following list are met with wherever rocks occur; *Scaphula* is found under stones, *Auricula* and *Cyrena* inhabit the salt swamp. *Teredo* perforates the dead trees. *Neritina cornucopia* is principally met with in this region, but is also found lower down the

\* Amongst others, I found species of *Dolium*, *Ricinuia*, *Ranella*, &c.

† I regret that my want of knowledge of botany and the paucity of the observations I was able to make upon the zoology, prevent me from entering fully into this subject. I can merely point out the fact that a distinction exists between the fauna and flora of the delta nearer to the coast, and that found further inland, and illustrate it in the single instance of the mollusca.

estuaries : *Littorina melanostoma* also occasionally occurs, but its home is nearer the sea.

Lower down where the creeks are broader, the belt of salt swamp is narrower in general, and a broad shelving muddy shore succeeds, the upper portion covered by a thick forest of *Avicensia*, while lower down *Nipa* palms frequently occur. The beauty of the wide creeks is greatly enhanced by the broad fringe of the bright green *Avicensia*, over the tops of which the summits of hills, covered with dense green forest, are frequently visible.\* On the sloping muddy shore species of *Potamides*, *Assiminia*, *Amphibola*, *Plecotrema*, *Haminea*, *Stenothyra*; *Arca granosa*, *Nassa planicostata*, and *Columbella Duclosiana* are to be met with. On the stems of the *Nipa* and on the mangrove bushes *Neritina crepidularia* and *N. cornucopia*, *Littorina melanostoma* and *L. scabra* are found in abundance.

I have only included in the present list those shells from the Bassein river which are found above Negrais Island, for the reasons already stated. I regret that the list is not more perfect, and that I am obliged to leave a few specimens undetermined. On the other hand the majority have been carefully compared, and the names quoted may, I think, in most cases, be relied upon. Immediately after leaving Pegu, I was in England for a few months; and owing to the kindness of the late Mr. S. P. Woodward, of Mr. Arthur Adams, and especially of the late Mr. Hugh Cuming, who allowed me to compare my shells with the original types in his unrivalled cabinet, I was enabled to determine, not merely my estuary collections, but also a much more numerous series of marine species from the Arakan coast, in a manner which would have been simply impossible in India.

Unfortunately, during the years which have elapsed since these shells were compared, a few have been mislaid or lost during constant travelling in various parts of India. Still I hope that this list may have some value as a contribution to our knowledge both of the geographical distribution and of the habitats of mollusca. Several of the species named, and some of the genera have, so far as I am aware, never before

\* So great is the height of the trees fringing the upper creeks, and so completely do they shut out all the surrounding country, that I was working amongst them for several days in ignorance of the existence of hills nearly 1000 feet high within 15 or 20 miles of me.

been shewn to inhabit the estuaries of India or Burma. Our estuary lists have hitherto been almost as imperfect as our catalogues of marine species; almost all that is known of the molluscan inhabitants of our deltas being due to the labours of Mr. Benson, who has described many of the forms found in the Ganges.

It is, of course, highly improbable that the present list is nearly complete. Only a very small portion of the Irawadi delta was examined, and that imperfectly. Still the number of species is considerable, and probably includes all those which are most abundant. A few forms since found by Mr. Theobald and Mr. Fedden will be noted in their place.

The classification employed is mainly that of Messrs. H. and A. Adams, in the Genera of Recent Mollusca. I have not, however, followed those authors in employing the obscure and forgotten generic terms of Klein, Montfort and others. I have only deviated from their arrangement in one essential particular, viz., the transfer of *Assiminia* from the vicinity of *Helix*, from which it differs in every point of structure, to that of *Littorina*, to which it is closely allied. If it be objected that *Assiminia* is as closely related to *Cyclostoma* as it is to *Littorina*, I can only suggest that *Cyclostoma* be also relegated to the same position in the neighbourhood of *Littorina*.

## Class GASTEROPODA.

### Sub-class PROSOBRANCHIATA.

#### Family BUCCINIDÆ.

#### No. 1, *Nassa planicostata*, A. Adams.

Estuary of the Bassein river, creeping upon mud between tidemarks. Scarce.

#### No. 2, *Purpura bitubercularis*, Lam.

Not common. Found in the lower part of the delta, with the next species.

#### Family MITRIDÆ.

#### No. 3, *Columbella Ducloziana*, Sow.

Found in abundance at one spot in the estuary of the Bassein river, amongst stones with mud. The specimens were unusually fine. I also met with this shell on the mud flats of Ramri Island, coast of Arakan.

Family SCALARIADÆ (*Scalidæ*, H. and A. Adams.)No. 4, *Scalaria*, sp.

A minute species, apparently new. As I possess but a solitary specimen, which is not in the best possible order, I hesitate to describe it. It is one of the smallest forms known, measuring only 3 millimetres in length. It was found under stones in the Myittaya creek.

## Family CERITHIIDÆ.

No. 5, *Cerithium* (*Vertagus*) *obeliscus*, Born.

A single specimen was found at Port Dalhousie.

No. 6, *Potamides* (*Tympanotonos*) *alatus*, Phil.No. 7, *Potamides* (*Tympanotonos*) *euriptera*, A. Ad.

Both this and the last species are met with abundantly on mud between tide marks, not far from the sea. They also occur on the sea coast where it is muddy.

No. 8, *Potamides* (*Telescopium*) *fuscus*, Chemn.

Common on mud between tidemarks, where the water is completely salt.

Besides the above, a species of *Cerithidea* has been found by Mr. Theobald in the estuaries of Burma. I did not meet with it.

## Family LITTORINIDÆ.

No. 9, *Littorina melanostoma*, Gray.

Very abundant upon "mangrove" trees, close to high water mark.

No. 10, *L. scabra*, L.

Occurs with the last, which appears to pass into it. Two varieties of this form occur, one more coarsely sculptured and more stoutly keeled than the other.

No. 11, *L. zic-zac*, Chemn.

Syn. *L. undulata*, Gray.

This species is frequently found on the sea coast, especially near mouths of rivers. In the estuary of the Bassein river, it occurs together with true estuarine forms. It is met with on stones and dead wood, close to high water mark.

## Family ASSIMINIIDÆ.

No 12, *Assiminia rubella*, W. Blanf. pl. II. fig. 11. 12.

A small roundly ovate, dull red species, which occurs abundantly

near Port Dalhousie, on mud between tidemarks. It is a characteristic *Assiminia*, though much shorter and rounder than the Bengal species *A. Francesiæ*, Gray, and belonging in fact to a different section of the genus. It is closely allied to some Singapore species and also to *A. marginata*, Leith, which inhabits Bombay, but may be distinguished from all by the double marginal impressed line below the suture.

The animal is deep red, with a black spot upon each of the lobes into which the proboscis is divided. The eyes are at the top of the short tentacles.

Family BISSOIDÆ.

IRAVADIA, n. g.

*Testa imperforata, turrata, spiraliter costata, solida, epidermide lecta : apertura ovata, integra, antice obsolete effusa ; peristomate recto, extus variciformi-incrassato, intus dilatato.*

*Animal ? Operculum ?*

Shell imperforate, turritid, spirally ribbed, rather thick, covered with an epidermis. Aperture ovate, without a canal, slightly effuse in front; peristome straight, not sinuate, with an external varix, and slightly expanded within. Animal and operculum unknown.

No. 13, *Iravadia ornata*, n. sp. Pl. II. fig. 13. 14.

*Testa turrata, decollata, subcylindrica, (junior elongato-conica), solida, spiraliter costata, inter costas confertim verticaliter costulata, sub epidermide olivaceâ vel ferrugineâ albida. Anfr. superst. 3-4, rotundati, superi tribus, penultimus quatuor, ultimus sex costis spiralibus ornati, hoc juxta aperturam paulo ascendente. Apertura sub-verticalis, elliptica, intus alba, (in testâ juniore postice angulata), antice subangulata et in testâ adultâ obsolete effusa, in juniore subcanaliculata ; peristoma extus incrassatum, nodoso-variciforme, nodis costis spiralibus congruentibus, intus vix expansum. Operc. ?*

*Long. 4½, diam. 2½ mill.*

Shell turritid, decollated (the young shell elongately conical,) thick, spirally ridged, with close vertical costulation between the ridges, white, with a brownish or olive epidermis. Whorls apparently about 6, when perfect, but only 3 or 4 remain in all the specimens collected; body whorl with 6 spiral ribs, of which 4 only appear on the penultimate whorl, and 3 on the upper whorls, the lower ribs being concealed. On all the upper whorls the 2nd and 3rd ridges are the

strongest. Those near the suture, both above and below, are less strongly marked, and are occasionally obsolete. On the last whorl the uppermost ridge near the suture is alone fainter than the others. The body whorl ascends a little towards the aperture, which is subvertical and nearly elliptical. The anterior canaliculation is obsolete in the adult, but it is well marked in the young shell. Peristome much thickened, externally variciform, the varix being nodose in consequence of the spiral ribs of the body whorl being continuous upon it. In young specimens the lip is grooved inside, the grooves corresponding to the external ribbing, and slight remains of this grooving may be traced in the adult shell.

I had at first classed this shell as a *Rissoina* on account of the obsolete canal, although it differs in essential characters from any species of that genus. I am indebted to my friend Dr. Stoliczka for calling my attention to the great distinctions which exist between the present form and *Rissoina*, and some of which equally serve to distinguish it from *Rissoa* and all other genera of the group. *Iravadia* differs from *Rissoina* in possessing an epidermis, in having spiral sculpture, in the peristome neither being sinuate above, nor projecting below, and in the columellar margin being simply curved in front and not excavated. From *Rissoa* it is distinguished also by its epidermis and sculpture, by the obsolete channel in front of the aperture, which, in young specimens, is quite as distinct as in *Rissoina*, and by the absence of any tendency to the columellar tooth or fold, which is so conspicuous in the typical species of the genus. The characters of the sculpture, epidermis, and aperture serve equally to separate the present form from *Alvania*, *Onoba*, *Ceratia* and other genera of *Rissoidea*: *Hydrobia* and *Amnicola* alone have an epidermis, but both are smooth shells without a variciform peristome.

It is unfortunate that no specimen of the operculum has been preserved. The few shells found were collected during a hurried journey in a boat. The species was only met with at one spot, under stones, amongst some rocks in a creek leading into the Myittaya, a branch of the Bassein river. Several specimens were obtained, but when an opportunity was afforded of examining them at leisure, the opercula had disappeared. In the absence of the operculum, I should be disposed to consider the genus as more nearly allied to *Rissoina* than to

any other, and such naturalists as may refuse generic rank to *Iravadia*, may perhaps best class it as a subgenus or section of that genus. It may have affinities with a curious species from Peru (*Rissoina sulcifera*, Trosc.) figured by Schwarz von Mohrenstern in his monograph of *Rissoina* in the Denksch. k. k. Akad. Wien, xix, 182, Taf. 10, fig. 83, and the differences between which and all other *Rissoinæ* are pointed out by that author.

The curious little shell dredged by Mr. A. Adams in the seas of Japan and described by him as *Vanesia sulcatina* in the Annals and Magazine of Natural History for 1861, Ser 3, vol. viii, p. 242, may also possibly have some affinities with *Iravadia*.

No. 14, *Stenothyra monilifera*, Bens. Pl. II, fig 15.

I found two specimens of this species at Port Dalhousie in the Bassein river. The type was first obtained by Mr. Theobald at Mergui and Rangoon, and the shell has since been found in Cochin China. As the species does not appear to have been figured, I add an illustration of it.

#### Family NERITINIDÆ.

No. 15, *Neritina Peguensis*, n. sp. Pl. I. fig. 1—16.

*Testa globosa, oblique ovalis, solida, confertim oblique subsinuate rugata, interdum spinigera, epidermide fusco-olivacea, minute flavo-punctulata, aliquando maculis oblongis subcurvatis flavis infra suturam ornatâ, vel fasciis subobsoletis spiralibus circumdatâ, induta, sub epidermide cærulea vel rubella, albido-maculata. Spira vix exserta, plerumque erosa, sutura elevato-compressa. Anfr. circa 3, superi planulato-concavi, ultimus superne ad suturam appressus, supra peripheriam aut carinatus, spinisque distantibus munitus, vel obsolete angulatus, subtus rotundatus. Apertura intus lactea; peristoma semiovale, area columellari planulatâ, luteolâ v. sordide albidâ, minute denticulatâ, plicâ unicâ majori intrante supramedianâ munitâ, antice edentatâ. Operc. extus planum, albidum, margine externâ nigra, intus rubrum.*

*Maj. diam.* 19, *min.* 15, *alt.* 19 mill. *Hab.* in rivulo ad Promontorium Negrais.

*Var. minor testâ magis rotundatâ, spinis omnino carentibus, fig. 13—16. Maj. diam.* 14, *min.* 11, *alt.* 15 mill.

*Hab.* ad Portum Dalhousie.

Shell globose, obliquely oval, solid, closely obliquely and rather sinuously wrinkled, sometimes bearing spines, covered with a dark epidermis. Colour generally dark olive with minute yellow specks, occasionally with oblong splashes of yellow below the suture; these generally curve backwards, and are sometimes, but rarely, of large size. Some shells are surrounded more or less obsoletely with yellow bands. Beneath the epidermis the shell is pink or bluish spotted with white. Young specimens are frequently pink, with yellow specks, in front of each of which is a black streak like a shadow. The spire is barely exerted, apex obtuse, and generally eroded, the erosion extending frequently down the spire, and often a portion of the outer surface of the last whorl itself is wanting; suture raised, compressed. Whorls 3, the upper ones frequently wanting, but when present, flattened or sub-concave. Last whorl concave and compressed against the suture above, then either carinate above the periphery and bearing short subdistant spines, or else obtusely, more or less obsoletely angulate. Below it is always rounded. Aperture milky within, peristome semioval, columellar area flat, yellow or dirty white, minutely denticulate, except in front, and having a prominent re-entering tooth just above the middle. Operculum pinkish white outside, exterior margin black, red inside.

The nearest ally to this form with which I am acquainted in *N. obscurata*, Recluz, which has a more expanded mouth, and more deeply emarginate columellar area, the whorls appear also rather differently shaped above.

The present species is eminently variable. The type occurred in abundance close to the beach in a small stream which descends from the hills close to Cape Negrais; specimens were especially abundant in a brackish pool at the beach, spinous and spineless shells occurred mixed together, and the presence or absence of spines is evidently of no importance. The spineless variety from Port Dalhousie was found in the salt water of the Bassein river, abounding along the strand between tide marks.

To illustrate the variation of this species, several specimens have been figured.

Specimens collected by Mr. Theobald in Arakan illustrate the gradual passage, by absolutely insensible gradations, of this form, into the very distinct *N. retifera*, Bens. of the Ganges delta.



No. 16, *Neritina obtusa*, Benson.

Scarce. I obtained two specimens on limestone rock at Thaman-dewa in the Bassein river.

No. 17, *Neritina Smithii* Gray.

Less common than in the estuary of the Ganges.

I have another species of *Neritina* belonging to the typical section from the estuary of a small stream running into the sea just north of Cape Negrais. I have been unable to identify it with any known species, and it may possibly be new.\*

No. 18, *Neritina* (*Dostia*) *depressa*, Benson, pl. I, fig. 17, 18, 19.

There are specimens of this shell amongst my Irawaddy collections: I think they are from Rangoon. The species is generally found in fresh or slightly brackish water, while *Neritina crepidularia* and *N. cornucopia* are chiefly met with nearer the sea, where the water is more salt. In Bombay Island, however, I have met with *N. depressa* on the sea shore.

No., 19, *Neritina* (*Dostia*) *crepidularia*, Less. Pl. I. fig. 20, 21, 22.

This shell and the next are found rather abundantly upon trees growing in places covered by water at each tide, and especially upon *Nipa* palms. *N. crepidularia* frequently occurs upon the sea shore, as well as in estuaries.

No. 20, *Neritina* (*Dostia*) *cornucopia*, Benson, pl. I. fig. 23, 24, 25.

Locally abundant. The shells found by me in Pegu differ slightly from the type, which is scarce in the Hoogly at Calcutta. In the latter, the apex of the shell is very nearly in the same plane as the edge of the peristome, sometimes actually so and touching it. In Pegu specimens, the peristome is free from the apex. The difference is very trifling, and there is slight variation in this character in specimens from the same river. In other respects, the shells appear to agree excellently.

I learned from Mr. Benson some years since that *Neritina melanostoma*, Troschel, is identical with *N. cornucopia*, the latter name having priority.† The figures of the former in Philippi's *Abbildungen*

\* Further examination shews it to be one of the forms already referred to as intermediate between *N. Peguensis* and *N. retifera*, B. It is smooth like the latter.

† *N. melanostoma* was published in Wiegman's *Archiv* for 1837, p. 179; *N. cornucopia* was described by Mr. Benson in this Journal for 1836. Vol. V. p. 748.

are poor, but the specimens were from Bengal, and they present no essential difference from immature shells of *cornucopia*, so Mr. Benson is doubtless correct. Reeve in *Conch. Icon.* quotes *N. melanostoma* as a synonym of *N. crepidularia* and ignores *N. cornucopia* altogether. Von Martens (*Malakoz. Blätter*, 1863, X, 127.) shews that the colour of the columella and lip is sometimes white and sometimes black in several *Neritinae* of the *Dostia* section.

The fact very probably is, that we have in this case an example of a phenomenon not uncommon in the animal kingdom. Two distinct races spring up side by side, arising from one type, and in the original locality do not change their form, but although they breed truly, they are only distinguishable by some slight constant distinction. As both, however, migrate into distant regions, the difference becomes greater, and at length both become so diverse, that no question can remain as to their being in common natural history talk, "distinct species." Thus while *Neritina cornucopia* and *N. depressa*, inhabiting the Ganges delta, are scarcely distinguishable from each other by any more important character than the colour of the aperture, the same shells in Pegu have varied so much, that each differs from the other at least as much as it does from their congener *N. crepidularia*. In other places the race representing *N. cornucopia* may be perfectly undistinguishable from *N. crepidularia*, as appears to have been observed by v. Martens in Singapore. It is highly probable that the origin of species through variation takes place in space as well as in time. More observations on this question are desirable.

Figures of the three forms occurring in the Pegu delta are added.

Family PALUDINIDÆ ?

No. 21, *Larina* ? *Burmana*, n. sp. Pl. II, fig. 1.

*Testa ovato-globosa, imperforata, tenuis, castanea, striatula, nitidula. Spira conoidea, apice erosula, sutura valde impressa. Anfr. 5, rotundati, sensim descendentes, ultimus tumidus, subtus rotundatus. Apertura vix obliqua, subelliptica, superne angulata; peristoma rectum, tenue, marginibus callo tenui junctis, columellari expansa. ? Operc. corneum. Long. 11, diam. 8 mill. Apertura  $7\frac{1}{2}$  mill. longa, 6 lata.*

Shell ovately globose, imperforate, thin, translucent, smooth, brownish, horny. Spire conoidal, apex eroded, suture deep. Whorls 5 (perhaps more in adult specimens), rounded, obsoletely striated, regu-

larly descending, the last tumid, rounded beneath. Aperture nearly vertical, subelliptical, angulate above. Peristome thin, straight, margins united by thin callus, columellar margin narrowly expanded.

The operculum of this peculiar species was unfortunately lost, and the animal was not observed. In the hurry of travelling, the specimens were placed in a box and forgotten, until the fleshy portions were too much decayed for examination. About half a dozen individuals were found under stones in the Myittaya creek, in the same place which yielded *Iravadia ornata* and other forms.

Mr. A. Adams, who very kindly aided me in determining some of the species contained in my Pegu collections, suggested that this shell might possibly be a second species of the genus *Larina*, established by him for an Australian shell, the animal of which also is unknown. In appearance this shell somewhat resembles a *Lymnea*. It is not impossible that it may have affinities with *Amphibola*. I have a distinct impression that the shells possessed a horny operculum, or I should have been disposed to class them in the *Velutinidæ*.

Family TECTURIDÆ.

No. 22, *Tectura fluviatilis*, n. sp. Pl. II, fig. 2, 3, 4.

*Testa depresso-conica, rotundato-ovalis, tenuis, epidermide fusco-olivaceâ induta, lineis radiantibus, striisque confertis minutis concentricis decussata, intus cæruleo albida, interdum fasciâ concentricâ lacteâ, vel etiam omnino hoc colore versus marginem saturata, ad apicem ferruginea. Apex subcentralis, erosa.*

Major diam.  $21\frac{1}{2}$  min. 20 alt. 6

„ 20 „ 17 „  $5\frac{1}{2}$

„ 14 „ 12 „ 4

Shell much depressed, conical, subcircularly oval, thin, covered with a very dark olive epidermis, always eroded at the apex, marked with fine radiating raised lines and with close and minute concentric striæ of growth; inside the shell is bluish white, sometimes with one or more milky concentric bands, or the whole interior is milky, except the apex which is invariably ferruginous, the area so coloured having some correspondence to the amount of external erosion, and the colour being evidently due to a deposition of shell inside to protect the animal as the external portion is corroded away.

This species is found on rocks, rarely on trunks of trees, in many of

the creeks near high water mark, in brackish water. It was not met with near the sea, where the water was very salt.

The foot is large, filling the cavity of the shell, muzzle broad, tentacles long and fine, mouth not notched beneath. It does not appear to keep to one place and form a hole for itself like some *Patellæ*, but it is very sluggish in its movements.

Sub-class OPISTHOBRANCHIATA.

Family BULLIDÆ.

No. 23, *Haminea tenera*, A. Ad.

Not common. In Bombay this species abounds upon mud flats. The animal is red.

Sub-class PULMONIFERA.

Family AURICULIDÆ.

No. 24, *Auricula Judæ*, L.

This species is completely blind, as has been noticed by von Martens (Ueber die Landschnecken der Molukken, Malakoz. Blätter; 1863, X. 126) and as is shewn in Eydoux's drawing copied in Mrs. Gray's mollusca. The same is the case with all other species of the same group which I have examined. In some instances, e. g. the Bombay species, which has received, I believe, a MS. name from Mr. Benson, the eyes may be detected beneath the skin by looking very carefully. (Von Martens observed this in one instance in *A. Judæ*.) Such eyes can, however, be of but little use as percipient points to the animals. There is, however, one group of true *Auriculæ*, typified by *A. subula*, Quoy and Gaimard, in which the eyes are normally developed, the same as in *Melampus*, *Cassidula*, and other *Auriculidæ*. A small species of this type inhabits Bombay. The forms belonging to this sub-division appear also distinguished by a more elevated spire. Further observations are, however, necessary before a division of the genus can be proposed on these grounds, as there appears great probability that the two forms pass into each other.

I found specimens of *A. Judæ* alive under the bark of dead trees, on muddy banks of creeks, in places overflowed by the tide. Unquestionably, so far as my experience goes, none of the Eastern *Auriculidæ* (*Auricula*, *Cassidula*, *Melampus*, *Pythia*, *Plecotrema*) are land shells, all are met with in places overflowed by salt or brackish water at every tide. They are in fact true estuary shells.

Some of the specimens of this species collected by me shew an almost complete passage into *A. dactylus* Pfeiffer, as described and figured in *Novitates Conchologicæ* I, 15, pl. V. fig. 15. 16. This species is stated by Mr. Theobald to be found at Mergui (J. A. S. B. for 1857, xxvi. 253.)

No. 25, *Auricula nitidula*, n. sp. Pl. II. fig. 5, 6.

*Testa non rimata, subfusiformi oblonga, solida, nitidula, sub epidermide olivaceâ alba, lineis impressis confertis verticalibus minutissime rugata, aliis spiralibus granulato-decussata, sculpturâ infra suturam magis impressâ. Spira conoidea, apice eroso, sutura impressa. Anfr. 5 convexi, ultimus vix descendens,  $\frac{2}{3}$  longitudinis subæquans, basi rotundatus. Apertura verticalis, plicæ parietales 2, supera parva, profunda, alia obliqua, plica columellaris haud valida, diagonalis : perist. crassum, marginibus callo tenui junctis, dextro superne vix sinuato, intus callo elevato incrassato.*

*Long. 28, diam.  $12\frac{1}{2}$  mill. Apertura c. perist. 19 mill. longa, intus 5 lata.*

Shell not rimate, subfusiformly oblong, solid, smooth, having a greasy lustre, white, epidermis olive, covered with minute granulations produced by the intersection of vertical and spiral impressed lines, both very close and the former sinuous, the sculpture being most strongly marked below the suture. Spire conoidal, apex eroded, suture impressed. Whorls 5 convex, the last nearly  $\frac{2}{3}$  of the whole length, scarcely descending, rounded at the base. Aperture vertical with 2 parietal plicæ, the upper one small, far inside; the lower strong, oblique; columellar plica moderate in size, diagonal; the peristome thick, the margins united by a thin callus which is somewhat expanded upon the penultimate whorl, the right margin scarcely sinuate above, and thickened inside.

This species which is found very rarely with the last, exactly resembles it in general form, but has rounded whorls and finer sculpture, besides being of much smaller size. The animal is white, while that of *A. Judæ* is mottled. *A. nitidula* somewhat resembles *A. Chinensis* Pfr. which, however, is much less attenuate below, and differs in the form of the aperture, &c.

But two or three specimens of this form were met with. In Mr. Theobald's lists of Burmese shells, *A. glans*, Bens. is mentioned. I can

find no description of this species, and cannot therefore say if it be the present form or not.

No. 26, *Plecotrema Cumingiana*, n. sp. Pl. II. fig. 16.

*Testa subrimata, subelliptico-ovata, solida, punctis impressis crebris, lineas spirales confertas formantibus, striisque incrementi obliquis ornata, ferrugineo-fusca. Spira conoidea, lateribus vix convexiusculis, apice erosa, sutura lævi lineari. Anfr. 4 superst., superi planulati, vix discreti, sulcis spiralibus punctatis 4 notati, ultimus ad peripheriam subangulatus, subtus compressiusculus. Apertura vix obliqua, plicis parietalibus 2, superiori brevi obliqua, alterâ intrante, extus bifidâ, plicâ columellari subobliquâ; peristoma rectum, pone limbum acutum intus callosum, margine dextro tridentato.*

*Long. 5, diam. 3 mill. Apert. 3½ mill. longa.*

Shell subrimate, subelliptically ovate, solid, marked with close spiral lines, formed of thickly set punctiform impressions, and with oblique striae of growth; reddish brown in colour. Spire conoidal, the sides barely convex, apex eroded, suture flat. Whorls 4 remaining, the upper flat, scarcely distinguishable, marked with 4 spiral dotted lines, the last whorl subangulate at the periphery, somewhat compressed below. Aperture very slightly oblique, with two parietal folds, the upper short, oblique, the lower re-entering, externally bifid, the columellar fold sub-oblique; peristome straight, margin sharp, but inside the sharp edge thickened and bearing 3 teeth within the right margin.

This species was rather scarce, crawling on mud in company with *Assiminea rubella*. It is distinguished from its allies, *P. striata*, Philippi, and *P. punctostriata*, H. and A. Adams, by its low spire and minute sculpture. In naming it after the late Mr. Hugh Cuming, I adopt the only means in my power of acknowledging my obligations to that gentleman for the very liberal manner in which he allowed me access to his collections, for the purpose of comparing and identifying my Pegu shells.

Besides the above *Auriculidæ*, I have received a *Pythia* which appears to be a variety of *P. trigona*, Troschel, from Mr. Theobald and Mr. Fedden, who both met with it on the Arakan coast, not far north of Cape Negrais. It is singular that I did not meet with species of either *Cassidula* or *Melampus*, as I have reason to believe that both inhabit the Irawadi delta or its immediate vicinity. Mr. Theobald has sent me *Cassidula aurisfelis*, Brug. from Arakan.

## Family AMPHIBOLIDÆ.

No. 27, *Amphibola Burmana*, n. sp. Pl. II, fig. 7—10.

*Testa aperte umbilicata, naticoidea, tenuiuscula, castanea, periomphalo plerumque saturatiori, nitidula, subsinuate striatula, infra suturam dense peroblique striata, lineâ una elevatâ spirali, interdum obsoletâ, superne haud procul a suturâ signata. Spira conoidea, apice vix obtusa, sutura profunda. Anfr. 4 rotundati, ultimus tumidus. Apertura ovata, superne recte angulata; peristoma vix interruptum, breviter adpatum, tenue, marginibus approximatis, callo tenui junctis, dextrali superne sinuatâ, basali rectâ, columellari breviter reflexo, umbilicûm partim tegente. Operculum corneum, paucispirale, nucleo basali, sinistro.*

*Alt. 10, diam.  $9\frac{1}{2}$  mill., apertura  $7\frac{1}{2}$  longa,  $5\frac{1}{2}$  lata.*

Shell openly umbilicated, naticoid, rather thin, orange-brown, darker around the umbilicus, smooth, marked with subsinuate lines of growth, closely and very obliquely striated just below the suture, with a single raised spiral line, which is sometimes obsolete, on the upper portion of each whorl. Spire conoidal, apex subacute, suture deep. Whorls 4, rounded, the last swollen. Aperture ovate, rectangular above; peristome scarcely interrupted, free, except for a very short distance, from the last whorl, thin, margins closely approximate, united by thin callus, right margin rather deeply sinuate above, basal straight, columellar turned back near the umbilicus, which it partly conceals. Operculum horny, paucispiral, nucleus basal, sinistral.

This is, I believe, the first instance in which the presence of *Amphibola* has been indicated in the Indian or Burmese seas or estuaries; nevertheless, it is very common. I found, in Mr. Cuming's collection, specimens of the same form as that above described, which were collected in Malacca by Dr. Traill, and a smaller form, scarcely separable as a race from the above, abounds in Bombay harbour.

The present species is nearly allied to *A. fragilis*, Quoy and Gaimard, but is thinner, with a lower spire. It was found abundantly crawling on mud, between tidemarks, in company with *Assiminea rubella* and *Plecotrema Cumingiana*. The animal was difficult to make out, as it consisted of an indistinct translucent mass. There were no tentacles, and the eyes were on very short lobate pedicels. The animal differs considerably from the figure of that of *Amp. fragilis*, as copied from Quoy and Gaimard by both Adams and Mrs. Gray.

## Class CONCHIFERA.

## Family PHOLADIDÆ.

No. 28, *Martesia fluminalis*, n. sp. Pl. III, fig. 1, 2, 3.

*Testa ovata-conica, valde inæquilateralis, antice hemispherica, postice sensim acuminata, extremitate membranacea, albidâ, tenuis. Valvæ versus margines epidermide crassâ, coriaced indutæ, pagina antica juxta cardinem costulis confertissimis, sinuatis, concentricis, lineisque radiatis elevatis decussantibus pulchre ornata, subtus glabra, postica concentrice striata. Callum trilobato-peltatum, medio divisum. Valvula dorsalis rudimentaria, cornea.*

*Lat.*  $12\frac{1}{2}$ , *long.* 6, *alt.*  $5\frac{1}{2}$  mill.

Shell ovately conical, white, thin, inequilateral, anterior extremity hemispherical, posterior regularly acuminate and membranaceous at the extreme end. Valves near the edges covered with a thick coriaceous epidermis, which in places, and especially towards the posterior extremity, extends beyond the margin and forms a membranaceous fringe, uniting the valves more or less. Each valve is divided into two parts by a line passing obliquely from the hinge to the ventral margin and inclined slightly backwards; in front of this line the shell near the hinge is decussated with very close sinuate concentric and subdistant radiating costulation; near the ventral margin it is smooth. Behind the oblique line the valves are concentrically striated, more or less indistinctly. The callus covering the hinges is trilobate and divided by a fissure in the centre; dorsal valve rudimentary, horny, commencing at some distance from the hinge, increasing in breadth backwards, but very narrow throughout.

This species appears most nearly allied to *M. rivicola*, Sow., which was found perforating floating logs in a river in Borneo. The present species is blunter and shorter, and *M. rivicola* is destitute of the sculpture on the anterior portion of the valves.

*M. fluminalis* was found boring in soft argillaceous sandstone, in creeks far from the sea, where the water was brackish. The external orifice in the stone is very minute, and must have been made by the shell when very young. Inside, the burrow exactly fits the shell, so that the only possible motion is rotation upon the longest axis of the shell.

The epidermis appears normally to cover the posterior subdivision of the valves, but it is always deficient, except towards the margins.



No. 29, *Teredo* ? sp.

All the dead trees in creeks in the Irawady delta are perforated throughout by a species of *Teredo* (?) I either omitted to take specimens, or else have lost them since, and I can now find none to which to refer. It is possible that this shell may be the *Teredo thoracites* of Dr. Gould,\* described in Vol. VI, of the Proceedings Boston Society of Natural History, and on which he subsequently, in Vol. VIII, proposed to found the subgenus *Calobates*, characterized by the "pallettes" (stylets) being "stilt shaped, bony." Dr. Gould's specimens were from Tavoy, but he does not mention if they were fluviatile or marine.

## Family CORBULIDÆ.

No. 30, *Sphenia perversa*, n. sp. Pl. III. fig. 4, 5, 6.

*Testa oblongo-ovata, parum inæquivalvis, valvâ dextrâ majori, tenuiuscula, alba, concentrica irregulariter striata, antice rotundata, postice acuminata, denu transverse truncata, ad extremitatem epidermide coriaceâ, rugatâ induta; margo dorsalis subrecta, ventralis antice convexa, postice vix concavâ. Processus cardinalis valvæ sinistrae (non dextræ) elongato-lamelliformis.*

*Lat. 11, long. 6, alt. 4 mill.*

Shell oblong, slightly inequivalve, broadest at the umbo, somewhat acuminate posteriorly, and very much more so in young specimens; thin, white, irregularly striated, the posterior end covered with a thick coriaceous epidermis which is vertically furrowed. In the young shell the epidermis covers all the shell except the beaks; it is thin except along the dorsal and posterior margins, where it is thick and vertically sulcated. The dorsal margin is nearly straight; the ventral rounded in front and slightly concave behind in old shells, straight or nearly so in young specimens. There is a lamelliform process in the hinge of the *left valve*, in front of the cartilage.

This shell was met with in burrows in stone, apparently the holes of *Martesia* which had perished, at least they did not appear to have been formed by the present species. It was met with at a considerable distance from the sea, in company with *Martesia fluminalis*.

In every respect, except the position of the lamellar tooth in the hinge of the left valve instead of the right, the shell appears to be a true

\* Otia Conchologica pp. 222, 241.

*Sphenia*. I scarcely think that the exceptional character justifies the creation of a new genus, as the characters of the animal unfortunately were not noted. The practice of establishing genera for single species on insufficient grounds is so objectionable, that it will be better to err in the opposite direction. When the animal has been examined, should it shew distinctions from *Sphenia*, it will be easy to propose a new generic or subgeneric appellation.

No. 31, *Corbula*, sp.

A single valve of a very thin species of *Corbula* was found on mud above Port Dalhousie.

● Family TELLINIDÆ.

No. 32, *Sanguinolaria diphos*, L.

This shell lives at a depth of about 4 feet in the mud. I found it abundantly in a marsh overflowed by every tide and where I should never have suspected its existence, had not my Burmese coolies pointed it out and shewn me how to capture specimens. Burmese, being omnivorous beings, are far better acquainted with the hiding places of various animals than the natives of India are; amongst other dainties they eat *Sanguinolariæ*, and the process for catching them which they shewed me was ingenious. The first thing was to cut a very thin slip of bamboo, about 5 feet long and not more than  $\frac{1}{2}$  inch in diameter, and to make a small barb at the end. This they thrust down all the small holes in the mud, many of which corresponded to the siphons of the *Sanguinolariæ* below. Now and then the bamboo went through a *Sanguinolaria*, as he lay vertically with his valves open below the mud; of course the bivalve immediately closed his valves upon the intruder, and was ignominiously dragged out by the bamboo, his exit being aided by digging when he approached the surface. The only objection to the plan is, that most of the specimens are slightly injured, as the shell closes with such force upon the bamboo as to break the thin ends of the valves. Some specimens were brought up in which the bamboo had been absolutely thrust down the siphon, thus literally impaling the *Sanguinolaria*. The siphons are of great length, considerably exceeding the shell.

No. 33, *Macoma ala*, Hanley.

No. 34, *Scrobicularia angulata*, Chem.

I find both the above shells recorded in my list. I cannot now come

across the specimens, and I am under the impression that they were found dead in salt water marshes on the Arakan coast, and not in the delta, but they are both so common in all Indian estuaries, that it is equally probable that I found them in the Bassein river.

Family VENERIDÆ.

No. 35, *Chione Ceylonensis*, Sow.

I have mislaid my notes as to the exact locality of this species also. I think it was found at Dalhousie. In a backwater on the Arakan coast, I found an allied, but undescribed species of the same genus.

No. 36, *Artemis*, sp.

Of this I have a single immature specimen. It may be the young of *A. excisa*, Chem. but has not the sculpture of that species, nor its angulate posterior slope.

Family CYRENIDÆ.

No. 37, *Cyrena Bengalensis*, Lam.

Mangrove and other salt water swamps along the edges of creeks, amongst roots of trees and brushwood, common.

I am inclined to refer the shells I obtained to the above form, of which I suspect some others since described are merely varieties. *Cyrenæ* vary greatly with age, besides being eminently variable in form. Thus some of my specimens exactly agree with *C. turgida* Desh., but I cannot help believing that they are merely immature specimens of the thicker form which I refer to *C. Bengalensis*.

Family MYTILIDÆ.

No. 38, *Mytilus smaragdinus*, Chem.

Found in creeks below low water mark. I do not think it is generally known that the flesh of this species is very delicious. Some were brought to me along with a quantity of oysters, and the Burmese told me that the mussels were the better eating of the two. Not having much faith in Burmese palates, I preserved the shells and threw away the soft parts of the *Mytili*; but as a trial, I had two or three cooked with the oysters. I found that the Burmese were quite right, though the oysters were by no means unpalatable.

No. 39, *Modiola emarginata*, Bens.

A dwarf variety of this species occurs in salt water creeks.

Family ARCIDÆ.

No. 40, *Arca (Anomalocardia) granosa*, L.

This very common species was only found at one spot in the Bassein river. It was living in mud close to the surface, under stones and

roots of plants. The same species abounds in mud, amongst stones, in Bombay harbour, and is collected for food by the natives.

No. 41, *Scaphula deltæ*, n. sp. Pl. III., fig. 7-10.

*Testa tumida, perelongato-rhomboidæa, sub' epidermide crassâ, fuscâ, posticè radiatim liratâ albida, lineis minutis elevatis confertissimis decussata, ante carinam costâ unicâ latâ, planulatâ, aliquando obsoletâ, a natibus ad marginem decurrente, munita, intus cærulescens, antice rotundata, postice oblique truncata, margine ventrali antice convexâ, postice vix concaviusculâ (testæ junioris rectâ). Carina perelevata, acuta, valvas in paginâ duas dividens, anticâ tumidâ, posticâ concavâ. Area nitida, sub lente striatula, ligamento rhombeo solum antice induta. Dentes cardinales postici breves, obliqui, ab extremitate remotiusculi.*

Lat. 10 long  $3\frac{1}{2}$  alt.  $6\frac{1}{2}$ .

„ 8 „ 3 „ 5.

Shell very tumid, elongately rhomboidal, (the ventral and dorsal margins being parallel as in *S. celox*) covered with a thick, dark epidermis, which is rather rough and radiately ribbed behind the keel. Beneath the epidermis the shell is white, and decussately very minutely sculptured, one flat broad rib, scarcely raised, and occasionally obsolete in old specimens, passing from the umbones to the margin just in front of the keel. This is scarcely distinguishable until the epidermis is removed. The valves are bluish within, rounded in front, obliquely truncated at the posterior margin; the ventral margin is convex anteriorly, subconcave posteriorly, being straight for the greater part of its course in young shells, but becoming slightly concave, at the spot where the byssus passes out, in old specimens. The keel is very high and sharp, separating the valves into two subdivisions, the anterior of which is tumid, the posterior concave. The area is polished and striated rather obliquely, the ligament diamond-shaped and covering only the anterior portion, about  $\frac{1}{3}$  to  $\frac{1}{2}$  the length, of the area. The hinge teeth are oblique, but less so than in either *S. celox* or *S. pinna*, and the posterior teeth are much farther from the extremity of the shell than in either of those species.

The great distinction between this species and the other two previously described is in the far greater tumidity of the valves, which are nearly twice as broad in their diameter from side to side (of the closed valves) as they are from the dorsal to the ventral margin. The proportion of the two diameters in the present species averages

about 12 : 7. In *S. celox* it is 12 : 10½ and in *S. pinna* 12 : 9½.\* The last named species is of a totally distinct form, being much wider posteriorly than in front, so that it is sub-trigonal in shape instead of rhomboidal. Its posterior hinge teeth, also, are near the extremity, and so oblique as to be almost parallel to the hinge line, while in its smooth, thin epidermis, marked concentric sculpture, and convex posterior subdivision of the valves, it differs widely from *S. delta*. The ligament of *S. pinna* covers a greater proportion of the length of the area, (about ¾,) than does that of *S. delta*. It is much narrower in proportion to its length, as is indeed the entire area, corresponding to the smaller tumidity of the valves. *S. celox* approaches more nearly to the present species, but is thinner and much less tumid, has its posterior hinge teeth more oblique and nearer to the extremity, and differs widely in sculpture.

*S. delta* was found under stones in creeks, adhering by a byssus. It was not met with near the sea. It is the first species of the genus that has been found in brackish water, both of the forms described by Mr. Benson being from large rivers far above the influence of the tide.

Mr. Benson mentions the occasional occurrence of a raised rib in front of the keel in *S. celox*. I have several specimens, which I received from Mr. Theobald, shewing this peculiarity. It differs entirely from the flattened subobsolete rib of *S. delta*.

Figures of all 3 species are added to illustrate the difference between them.

#### Family ANOMIAIDÆ.

##### No. 42, *Anomia*, sp.

The specimens of this shell have unfortunately been mislaid. I only obtained two or three specimens, and it is extremely difficult to make out the species of this genus.

##### No. 43, *Anomia* (*Ænigma*) *ænigmatica*, Chem.

Occasionally found adhering to stumps of trees in salt water creeks.

#### Family OSTREIDÆ.

##### No. 44, *Ostrea*, sp. (? 2 sp.)

A large form occurs in the creeks below low water mark. A smaller kind is met with between tide marks in mangrove swamps and creeks, attached to wood or stones. I unfortunately omitted to take specimens of either.

\* Measured from authentic specimens of each species.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of March 1866.*

Latitude 22° 23' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the sea level, 18-11 feet

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Date. | Mean Height of<br>the Barometer<br>at 32° Fahrt. | Range of the Barometer<br>during the day. |         |         | Mean Dry Bulb<br>Thermometer. | Range of the Tempera-<br>ture during the day. |      |       |
|-------|--------------------------------------------------|-------------------------------------------|---------|---------|-------------------------------|-----------------------------------------------|------|-------|
|       |                                                  | Max.                                      | Min.    | Diff.   |                               | Max.                                          | Min. | Diff. |
|       | Inches.                                          | Inches.                                   | Inches. | Inches. | o                             | o                                             | o    | o     |
| 1     | 29.789                                           | 29.866                                    | 29.740  | 0.126   | 81.4                          | 93.6                                          | 72.8 | 20.8  |
| 2     | .821                                             | .898                                      | .748    | .150    | 82.3                          | 92.8                                          | 74.5 | 18.3  |
| 3     | .821                                             | .927                                      | .745    | .182    | 81.4                          | 91.7                                          | 72.4 | 19.3  |
| 4     | .756                                             | .818                                      | .678    | .140    | 81.8                          | 93.6                                          | 72.0 | 21.6  |
| 5     | .786                                             | .865                                      | .732    | .133    | 82.4                          | 94.8                                          | 72.4 | 22.4  |
| 6     | .816                                             | .892                                      | .757    | .135    | 81.8                          | 94.0                                          | 71.4 | 22.6  |
| 7     | .792                                             | .860                                      | .724    | .136    | 82.6                          | 94.0                                          | 75.4 | 18.6  |
| 8     | .793                                             | .876                                      | .719    | .157    | 83.4                          | 95.2                                          | 72.5 | 22.7  |
| 9     | .800                                             | .872                                      | .732    | .140    | 83.8                          | 95.0                                          | 75.4 | 19.6  |
| 10    | .784                                             | .859                                      | .719    | .140    | 83.4                          | 94.4                                          | 76.7 | 17.7  |
| 11    | .858                                             | .937                                      | .775    | .162    | 83.6                          | 92.4                                          | 76.8 | 15.6  |
| 12    | .977                                             | 30.060                                    | .900    | .160    | 83.4                          | 92.4                                          | 77.4 | 15.0  |
| 13    | .967                                             | .066                                      | .872    | .184    | 83.3                          | 92.2                                          | 77.8 | 14.4  |
| 14    | .845                                             | 29.945                                    | .764    | .181    | 86.4                          | 96.4                                          | 77.9 | 18.5  |
| 15    | .828                                             | .924                                      | .761    | .163    | 84.3                          | 94.0                                          | 76.6 | 17.4  |
| 16    | .871                                             | .952                                      | .812    | .140    | 84.5                          | 94.0                                          | 79.0 | 15.0  |
| 17    | .885                                             | .970                                      | .822    | .148    | 84.0                          | 94.4                                          | 77.0 | 17.4  |
| 18    | .820                                             | .899                                      | .750    | .149    | 83.4                          | 92.9                                          | 77.0 | 15.9  |
| 19    | .798                                             | .869                                      | .729    | .140    | 84.5                          | 95.0                                          | 77.6 | 17.4  |
| 20    | .842                                             | .921                                      | .779    | .142    | 84.3                          | 94.0                                          | 76.6 | 17.4  |
| 21    | .798                                             | .878                                      | .703    | .175    | 85.5                          | 96.5                                          | 76.8 | 19.7  |
| 22    | .717                                             | .803                                      | .619    | .184    | 86.7                          | 98.6                                          | 77.8 | 20.8  |
| 23    | .715                                             | .790                                      | .663    | .127    | 86.4                          | 98.4                                          | 77.8 | 20.6  |
| 24    | .751                                             | .838                                      | .684    | .154    | 84.9                          | 95.3                                          | 77.6 | 17.7  |
| 25    | .748                                             | .827                                      | .678    | .149    | 86.4                          | 96.2                                          | 81.0 | 15.2  |
| 26    | .700                                             | .769                                      | .626    | .143    | 87.4                          | 97.4                                          | 80.7 | 16.7  |
| 27    | .730                                             | .811                                      | .668    | .143    | 86.1                          | 95.1                                          | 79.5 | 15.6  |
| 28    | .812                                             | .914                                      | .743    | .171    | 84.9                          | 93.2                                          | 76.0 | 17.2  |
| 29    | .859                                             | .960                                      | .771    | .189    | 81.9                          | 91.6                                          | 73.8 | 17.8  |
| 30    | .855                                             | .927                                      | .775    | .152    | 81.0                          | 91.0                                          | 72.4 | 18.6  |
| 31    | .806                                             | .887                                      | .739    | .148    | 83.7                          | 93.0                                          | 77.0 | 16.0  |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of March 1866.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Date. | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>vapour. | Mean Weight of Vapour<br>in a Cubic foot of air. | Additional Weight of<br>Vapour required for<br>complete saturation. | Mean degree of Humi-<br>dity complete satu-<br>ration being unity. |
|-------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|---------------------------------------------------------------------|--------------------------------------------------------------------|
|       | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                           | T. gr.                                                              |                                                                    |
| 1     | 72.9                            | 8.5                 | 66.9                | 14.5                         | 0.657                            | 7.06                                             | 4.21                                                                | 0.63                                                               |
| 2     | 72.8                            | 9.5                 | 66.1                | 16.2                         | .640                             | 6.87                                             | .71                                                                 | .59                                                                |
| 3     | 70.3                            | 11.1                | 62.5                | 18.9                         | .568                             | .11                                              | 5.16                                                                | .54                                                                |
| 4     | 69.4                            | 12.4                | 60.7                | 21.1                         | .536                             | 5.75                                             | .65                                                                 | .50                                                                |
| 5     | 70.2                            | 12.2                | 61.7                | 20.7                         | .554                             | .93                                              | .68                                                                 | .51                                                                |
| 6     | 69.4                            | 12.4                | 60.7                | 21.1                         | .536                             | .75                                              | .65                                                                 | .50                                                                |
| 7     | 76.9                            | 5.7                 | 72.9                | 9.7                          | .797                             | 8.56                                             | 3.12                                                                | .73                                                                |
| 8     | 74.5                            | 8.9                 | 68.3                | 15.1                         | .688                             | 7.37                                             | 4.59                                                                | .62                                                                |
| 9     | 77.2                            | 6.6                 | 72.6                | 11.2                         | .790                             | 8.47                                             | 3.63                                                                | .70                                                                |
| 10    | 77.3                            | 6.1                 | 73.0                | 10.4                         | .801                             | .58                                              | .38                                                                 | .72                                                                |
| 11    | 72.8                            | 10.8                | 65.2                | 18.4                         | .621                             | 6.66                                             | 5.37                                                                | .55                                                                |
| 12    | 75.3                            | 8.1                 | 69.6                | 13.8                         | .717                             | 7.68                                             | 4.28                                                                | .64                                                                |
| 13    | 76.7                            | 6.6                 | 72.1                | 11.2                         | .778                             | 8.34                                             | 3.59                                                                | .70                                                                |
| 14    | 77.1                            | 9.3                 | 70.6                | 15.8                         | .741                             | 7.89                                             | 5.17                                                                | .60                                                                |
| 15    | 75.0                            | 9.3                 | 68.5                | 15.8                         | .692                             | .41                                              | 4.87                                                                | .60                                                                |
| 16    | 73.5                            | 11.0                | 65.8                | 18.7                         | .634                             | 6.77                                             | 5.58                                                                | .55                                                                |
| 17    | 74.2                            | 9.8                 | 67.3                | 16.7                         | .666                             | 7.12                                             | .05                                                                 | .59                                                                |
| 18    | 74.8                            | 8.6                 | 68.8                | 14.6                         | .699                             | .48                                              | 4.48                                                                | .63                                                                |
| 19    | 75.6                            | 8.9                 | 69.4                | 15.1                         | .713                             | .62                                              | .73                                                                 | .62                                                                |
| 20    | 73.6                            | 10.7                | 66.1                | 18.2                         | .640                             | 6.84                                             | 5.44                                                                | .56                                                                |
| 21    | 75.4                            | 10.1                | 68.3                | 17.2                         | .688                             | 7.34                                             | .38                                                                 | .58                                                                |
| 22    | 76.3                            | 10.4                | 70.1                | 16.6                         | .729                             | .76                                              | .42                                                                 | .59                                                                |
| 23    | 75.6                            | 10.8                | 68.0                | 18.4                         | .681                             | .26                                              | .80                                                                 | .56                                                                |
| 24    | 78.6                            | 6.3                 | 74.2                | 10.7                         | .832                             | 8.89                                             | 3.60                                                                | .71                                                                |
| 25    | 79.6                            | 6.8                 | 74.8                | 11.6                         | .849                             | 9.04                                             | 4.02                                                                | .69                                                                |
| 26    | 80.8                            | 6.6                 | 76.8                | 10.6                         | .905                             | .61                                              | 3.84                                                                | .71                                                                |
| 27    | 76.3                            | 9.8                 | 69.4                | 16.7                         | .713                             | 7.59                                             | 5.36                                                                | .59                                                                |
| 28    | 79.1                            | 5.8                 | 75.0                | 9.9                          | .854                             | 9.12                                             | 3.37                                                                | .73                                                                |
| 29    | 75.1                            | 6.8                 | 70.3                | 11.6                         | .734                             | 7.89                                             | .55                                                                 | .69                                                                |
| 30    | 75.1                            | 5.9                 | 71.0                | 10.0                         | .751                             | 8.09                                             | .05                                                                 | .73                                                                |
| 31    | 77.3                            | 6.4                 | 72.8                | 10.9                         | .795                             | .52                                              | .55                                                                 | .71                                                                |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations*

*taken at the Surveyor General's Office, Calcutta,*

*in the month of March 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

| Hour.      | Mean Height of the Barometer at 32° Falt. | Range of the Barometer for each hour during the month. |         |         | Mean Dry Bulb Thermometer. | Range of the Temperature for each hour during the month. |      |       |
|------------|-------------------------------------------|--------------------------------------------------------|---------|---------|----------------------------|----------------------------------------------------------|------|-------|
|            |                                           | Max.                                                   | Min.    | Diff.   |                            | Max.                                                     | Min. | Diff. |
|            | Inches.                                   | Inches.                                                | Inches. | Inches. | o                          | o                                                        | o    | o     |
| Mid-night. | 29.821                                    | 30.007                                                 | 29.706  | 0.301   | 79.1                       | 82.8                                                     | 72.5 | 10.3  |
| 1          | .807                                      | .001                                                   | .696    | .305    | 78.6                       | 82.0                                                     | 72.4 | 9.6   |
| 2          | .794                                      | 29.985                                                 | .682    | .303    | 78.1                       | 81.6                                                     | 72.8 | 8.8   |
| 3          | .784                                      | .978                                                   | .671    | .307    | 77.5                       | 81.5                                                     | 72.8 | 8.7   |
| 4          | .781                                      | .982                                                   | .668    | .314    | 77.2                       | 81.6                                                     | 72.8 | 8.8   |
| 5          | .796                                      | .995                                                   | .687    | .308    | 76.8                       | 81.4                                                     | 71.6 | 9.8   |
| 6          | .815                                      | 30.009                                                 | .707    | .302    | 76.4                       | 81.1                                                     | 71.5 | 9.6   |
| 7          | .839                                      | .025                                                   | .730    | .295    | 76.7                       | 81.4                                                     | 71.4 | 10.0  |
| 8          | .869                                      | .043                                                   | .748    | .295    | 78.8                       | 82.8                                                     | 73.8 | 9.0   |
| 9          | .885                                      | .055                                                   | .761    | .294    | 81.9                       | 86.6                                                     | 76.6 | 10.0  |
| 10         | .889                                      | .060                                                   | .751    | .309    | 85.1                       | 89.8                                                     | 80.0 | 9.8   |
| 11         | .878                                      | .056                                                   | .769    | .287    | 87.9                       | 92.4                                                     | 83.8 | 8.6   |
| Noon.      | .851                                      | .031                                                   | .740    | .291    | 90.3                       | 94.6                                                     | 87.6 | 7.0   |
| 1          | .818                                      | .003                                                   | .711    | .292    | 92.0                       | 96.0                                                     | 89.2 | 6.8   |
| 2          | .784                                      | 29.976                                                 | .666    | .310    | 93.4                       | 97.4                                                     | 91.0 | 6.4   |
| 3          | .761                                      | .057                                                   | .642    | .315    | 94.1                       | 98.4                                                     | 90.6 | 7.8   |
| 4          | .748                                      | .933                                                   | .625    | .308    | 94.0                       | 98.6                                                     | 89.8 | 8.8   |
| 5          | .745                                      | .939                                                   | .619    | .320    | 92.5                       | 97.4                                                     | 87.6 | 9.8   |
| 6          | .752                                      | .950                                                   | .624    | .326    | 88.9                       | 93.6                                                     | 84.6 | 9.0   |
| 7          | .769                                      | .964                                                   | .633    | .331    | 86.0                       | 90.6                                                     | 82.6 | 8.0   |
| 8          | .793                                      | .990                                                   | .666    | .324    | 84.0                       | 87.0                                                     | 81.6 | 5.4   |
| 9          | .819                                      | 30.009                                                 | .693    | .316    | 82.1                       | 84.8                                                     | 73.8 | 11.0  |
| 10         | .830                                      | .021                                                   | .707    | .314    | 80.9                       | 83.8                                                     | 76.2 | 7.6   |
| 11         | .831                                      | .019                                                   | .706    | .303    | 79.8                       | 83.0                                                     | 74.2 | 8.8   |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.



*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of March 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Hour.          | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>Vapour. | Mean Weight of Vapour<br>in a Cubic foot of air. | Additional Weight of<br>Vapour required for<br>complete saturation. | Mean degree of Humi-<br>dity, complete satura-<br>tion being unity. |
|----------------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
|                | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                           | T. gr.                                                              |                                                                     |
| Mid-<br>night. | 75.8                            | 3.3                 | 73.5                | 5.6                          | 0.814                            | 8.79                                             | 1.74                                                                | 0.84                                                                |
| 1              | 75.6                            | 3.0                 | 73.5                | 5.1                          | .814                             | .81                                              | .57                                                                 | .85                                                                 |
| 2              | 75.4                            | 2.7                 | 73.5                | 4.6                          | .814                             | .81                                              | .41                                                                 | .86                                                                 |
| 3              | 75.0                            | 2.5                 | 73.2                | 4.3                          | .806                             | .75                                              | .29                                                                 | .87                                                                 |
| 4              | 74.7                            | 2.5                 | 72.9                | 4.3                          | .797                             | .66                                              | .29                                                                 | .87                                                                 |
| 5              | 74.5                            | 2.3                 | 72.9                | 3.9                          | .797                             | .66                                              | .17                                                                 | .88                                                                 |
| 6              | 74.2                            | 2.2                 | 72.7                | 3.7                          | .792                             | .61                                              | .11                                                                 | .89                                                                 |
| 7              | 74.6                            | 2.1                 | 73.1                | 3.6                          | .803                             | .72                                              | .08                                                                 | .89                                                                 |
| 8              | 75.2                            | 3.6                 | 72.7                | 6.1                          | .792                             | .58                                              | .86                                                                 | .82                                                                 |
| 9              | 75.8                            | 6.1                 | 71.5                | 10.4                         | .763                             | .21                                              | 3.23                                                                | .72                                                                 |
| 10             | 75.7                            | 9.4                 | 69.1                | 16.0                         | .706                             | 7.53                                             | 5.04                                                                | .60                                                                 |
| 11             | 75.0                            | 12.9                | 67.3                | 20.6                         | .666                             | .06                                              | 6.58                                                                | .52                                                                 |
| Noon.          | 74.9                            | 15.4                | 65.7                | 24.6                         | .632                             | 6.68                                             | 7.95                                                                | .46                                                                 |
| 1              | 74.6                            | 17.4                | 64.2                | 27.8                         | .601                             | .32                                              | 9.04                                                                | .41                                                                 |
| 2              | 74.5                            | 18.9                | 63.2                | 30.2                         | .582                             | .11                                              | .88                                                                 | .38                                                                 |
| 3              | 74.3                            | 19.8                | 62.4                | 31.7                         | .567                             | 5.93                                             | 10.39                                                               | .36                                                                 |
| 4              | 74.9                            | 19.1                | 63.4                | 30.6                         | .586                             | 6.13                                             | .14                                                                 | .38                                                                 |
| 5              | 75.1                            | 17.4                | 64.7                | 27.8                         | .611                             | .43                                              | 9.16                                                                | .41                                                                 |
| 6              | 75.1                            | 13.8                | 66.8                | 22.1                         | .655                             | .94                                              | 7.10                                                                | .49                                                                 |
| 7              | 75.5                            | 10.5                | 68.1                | 17.9                         | .684                             | 7.28                                             | 5.63                                                                | .56                                                                 |
| 8              | 75.1                            | 8.9                 | 68.9                | 15.1                         | .701                             | .51                                              | 4.66                                                                | .62                                                                 |
| 9              | 75.3                            | 6.8                 | 70.5                | 11.6                         | .739                             | .93                                              | 3.58                                                                | .69                                                                 |
| 10             | 75.8                            | 5.1                 | 72.2                | 8.7                          | .781                             | 8.40                                             | 2.70                                                                | .76                                                                 |
| 11             | 75.9                            | 3.9                 | 73.2                | 6.6                          | .806                             | .70                                              | 2.05                                                                | .81                                                                 |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of March 1866.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | General Aspect of the Sky.                                                                                             |
|-------|-----------------------|---------------------------------|-----------------------------------|------------------------------------------------------------------------------------------------------------------------|
|       | o                     | Inches                          |                                   |                                                                                                                        |
| 1     | 146.0                 | ...                             | N. W. & W. & S.                   | Clear.                                                                                                                 |
| 2     | 142.0                 | ...                             | W.                                | Clear.                                                                                                                 |
| 3     | 142.8                 | ...                             | W. & S. W.                        | Clear.                                                                                                                 |
| 4     | 141.6                 | ...                             | W. & S. W & S.                    | Clear.                                                                                                                 |
| 5     | 148.5                 | ...                             | W. & S.                           | Clear.                                                                                                                 |
| 6     | 142.0                 | ...                             | W.                                | Clear.                                                                                                                 |
| 7     | 141.5                 | ...                             | S. & S. W.<br>S. & W.             | Clear. Scuds from S. between 4 & 7 A.M.<br>Clear to 4 A. M., scatd. \i to 9 A. M.,<br>clear afterwards.                |
| 8     | 142.4                 | ...                             | S. W.                             | Clear, slightly foggy from 4 to 6 A. M.                                                                                |
| 9     | 136.4                 | ...                             | S. & N.                           | Clear, slightly foggy from 3 to 8 A. M.                                                                                |
| 10    | 137.2                 | ...                             | N. & W.                           | Clear, slightly foggy at 4 A. M.                                                                                       |
| 11    | 140.0                 | ...                             | S. & N.                           | Clear.                                                                                                                 |
| 12    | 142.0                 | ...                             | S. & S. W.                        | Clear to 2 A. M., overcast to 6 A. M.,<br>clear afterwards.                                                            |
| 13    | 137.0                 | ...                             | S. & W.                           | Clear, slightly foggy at 1 A. M.                                                                                       |
| 14    | 140.0                 | ...                             | S. & W.                           | Clear, slightly foggy from 3 to 5 A. M.                                                                                |
| 15    | 141.0                 | ...                             | S. W. & W.                        | Scatd. clouds to 8 A. M., clear after-<br>wards.                                                                       |
| 16    | 150.0                 | ...                             | S. & N.                           | Clear to 7 A. M. \i to 7 P. M., clear<br>afterwards.                                                                   |
| 17    | 137.0                 | ...                             | S. & S. W.                        | \i to 8 P. M., clear afterwards.                                                                                       |
| 18    | 134.7                 | ...                             | W. & S. & S. W.                   | \i to 8 A. M., clear afterwards.                                                                                       |
| 19    | 142.0                 | ...                             | S. W. & W. & N. W.                | Clear, foggy from 4 to 7 A. M.                                                                                         |
| 20    | 140.0                 | ...                             | W. & S. W. & S.                   | Clear to 1 P. M., scatd. \i to 6 P. M.,<br>clear afterwards.                                                           |
| 21    | 142.0                 | ...                             | S. W. & W. & S.                   | Clear.                                                                                                                 |
| 22    | 142.0                 | ...                             | S. & W.                           | Clear.                                                                                                                 |
| 23    | 146.0                 | ...                             | S.                                | Clear.                                                                                                                 |
| 24    | 140.5                 | ...                             | S. & S. W.                        | Scatd. \i to 9 A. M., clear afterwards.                                                                                |
| 25    | 141.0                 | ...                             | S.                                | Clouds of different kinds.                                                                                             |
| 26    | 146.0                 | ...                             | S.                                | Clear.                                                                                                                 |
| 27    | 142.5                 | ...                             | S.                                | Clear to 6 A. M., scatd. \i to 5 P. M.,<br>overcast afterwards. Thin rain Light-<br>ning. and Thunder at 10 & 11 P. M. |
| 28    | 137.0                 | ...                             | S.                                | Overcast to 6 A. M., scatd. \i to 8 P. M.,<br>over cast afterwards Thin rain at<br>11 P. M.                            |
| 29    | 132.0                 | ...                             | S.                                |                                                                                                                        |

\i Cirri, — i Strati, \i Cumuli, \i Cirro-strati, \i Cumulo strati, \i Nimbi,  
\i Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of March 1866.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | General Aspect of the Sky.                           |
|-------|-----------------------|---------------------------------|-----------------------------------|------------------------------------------------------|
| 30    | 135.0                 | ...                             | S.                                | Vi to 10 A. M. Vi to 4 P. M., clear afterwards.      |
| 31    | 137.0                 | ...                             | E. & S. & S. W.                   | Clear to 4 A. M. Vi to 1 P. M. Scatd. Vi afterwards. |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta, in the  
month of March 1866.*

MONTHLY RESULTS.

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|                                                                   | Inches. |
|-------------------------------------------------------------------|---------|
| Mean height of the Barometer for the month, ...                   | 29.811  |
| Max. height of the Barometer occurred at 10 A. M. on the 12th, .. | 30.060  |
| Min. height of the Barometer occurred at 5 P. M. on the 22nd, ..  | 29.619  |
| <i>Extreme range</i> of the Barometer during the month, ..        | 0.441   |
| Mean of the daily Max. Pressures, ... ..                          | 29.893  |
| Ditto ditto Min. ditto ... ..                                     | 29.740  |
| <i>Mean daily range</i> of the Barometer during the month, ...    | 0.153   |

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|                                                                 |      |
|-----------------------------------------------------------------|------|
| Mean Dry Bulb Thermometer for the month, ... ..                 | 83.9 |
| Max. Temperature occurred at 4 P. M. on the 22nd, ..            | 98.6 |
| Min. Temperature occurred at 7 A. M. on the 6th, ..             | 71.4 |
| <i>Extreme range</i> of the Temperature during the month, ..    | 27.2 |
| Mean of the daily Max. Temperature ... ..                       | 94.3 |
| Ditto ditto Min. ditto, ... ..                                  | 76.1 |
| <i>Mean daily range</i> of the Temperature during the month, .. | 18.2 |

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|                                                               |      |
|---------------------------------------------------------------|------|
| Mean Wet Bulb Thermometer for the month, ... ..               | 75.1 |
| Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer, .. | 8.8  |
| Computed Mean Dew-point for the month, ... ..                 | 68.9 |
| Mean Dry Bulb Thermometer above computed mean Dew-point. ...  | 15.0 |

|                                                 | Inches. |
|-------------------------------------------------|---------|
| Mean Elastic force of Vapour for the month, ... | 0.701   |

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|                                                                        | Troy grains. |
|------------------------------------------------------------------------|--------------|
| Mean Weight of Vapour for the month ... ..                             | 7.51         |
| Additional Weight of Vapour required for complete saturation, ...      | 4.62         |
| Mean degree of humidity for the month, complete saturation being unity | 0.62         |

---

|                                                           | Inches.         |
|-----------------------------------------------------------|-----------------|
| Drizzled 2 days,—Max. fall of rain during 24 hours ... .. | Nil             |
| Total amount of rain during the month, ... ..             | Nil             |
| Prevailing direction of the Wind, ... ..                  | S. & W. & S. W. |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of March 1866.*

## MONTHLY RESULTS.

Tables shewing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.

| Hour.     | N. | Rain on.<br>N. E. | Rain on.<br>E. | Rain on.<br>S. E. | Rain on.<br>S. | Rain on.<br>S. W. | Rain on.<br>W. | Rain on.<br>N. W. | Rain on.<br>Calm. | Rain on.<br>Missed. |
|-----------|----|-------------------|----------------|-------------------|----------------|-------------------|----------------|-------------------|-------------------|---------------------|
| Midnight. |    |                   |                |                   |                |                   |                |                   |                   |                     |
| 1         |    |                   | 1              | 2                 | 18             | 7                 | 3              |                   |                   |                     |
| 2         |    |                   | 1              | 2                 | 18             | 8                 | 2              |                   |                   |                     |
| 3         |    |                   |                |                   | 20             | 8                 | 2              |                   |                   |                     |
| 4         |    |                   |                | 1                 | 17             | 8                 | 4              |                   |                   | 1                   |
| 5         |    |                   |                | 1                 | 15             | 9                 | 5              |                   |                   | 1                   |
| 6         |    |                   |                | 1                 | 13             | 10                | 6              |                   |                   | 1                   |
| 7         | 1  | 1                 |                |                   | 14             | 9                 | 5              |                   |                   | 1                   |
| 8         | 3  |                   | 1              |                   | 12             | 11                | 5              |                   |                   | 1                   |
| 9         | 1  |                   |                |                   | 11             | 11                | 6              |                   |                   |                     |
| 10        | 2  |                   |                |                   | 9              | 9                 | 10             | 2                 |                   |                     |
| 11        | 5  | 1                 |                | 1                 | 5              | 10                | 10             | 4                 |                   |                     |
|           |    |                   |                |                   | 3              | 6                 | 9              | 6                 |                   |                     |
| Noon.     |    |                   |                |                   |                |                   |                |                   |                   |                     |
| 1         | 5  | 2                 | 1              | 1                 | 5              | 4                 | 7              | 6                 |                   |                     |
| 2         | 2  | 2                 | 2              |                   | 3              | 6                 | 11             | 5                 |                   |                     |
| 3         | 2  | 1                 | 2              | 1                 | 3              | 3                 | 15             | 4                 |                   |                     |
| 4         | 4  |                   | 2              | 1                 | 2              | 6                 | 15             | 1                 |                   |                     |
| 5         | 3  |                   | 2              | 1                 | 6              | 3                 | 15             | 1                 |                   |                     |
| 6         | 3  | 1                 | 1              | 1                 | 8              | 2                 | 14             | 1                 |                   |                     |
| 7         | 2  | 1                 | 2              |                   | 9              | 2                 | 13             | 2                 |                   |                     |
| 8         | 2  | 1                 | 2              |                   | 14             | 1                 | 9              | 2                 |                   |                     |
| 9         | 2  |                   | 1              |                   | 17             | 1                 | 9              | 1                 |                   |                     |
| 10        | 1  |                   | 1              |                   | 21             | 3                 | 4              | 1                 |                   |                     |
| 11        | 1  |                   |                | 1                 | 21             | 5                 | 3              |                   |                   |                     |
|           |    |                   |                | 1                 | 19             | 6                 | 4              | 2                 | 1                 |                     |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of April 1866.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the sea level, 18-11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Date. | Mean Height of<br>the Barometer<br>at 32° Fahr. | Range of the Barometer<br>during the day. |         |         | Mean Dry Bulb<br>Thermometer. | Range of the Tempera-<br>ture during the day. |      |       |
|-------|-------------------------------------------------|-------------------------------------------|---------|---------|-------------------------------|-----------------------------------------------|------|-------|
|       |                                                 | Max.                                      | Min.    | Diff.   |                               | Max.                                          | Min. | Diff. |
|       | Inches.                                         | Inches.                                   | Inches. | Inches. | °                             | °                                             | °    | °     |
| 1     | 29.842                                          | 29.976                                    | 29.781  | 0.195   | 82.5                          | 89.9                                          | 76.9 | 13.0  |
| 2     | .844                                            | .915                                      | .796    | .119    | 82.6                          | 91.8                                          | 76.4 | 15.4  |
| 3     | .853                                            | .955                                      | .801    | .154    | 77.4                          | 83.4                                          | 73.6 | 9.8   |
| 4     | .811                                            | .882                                      | .753    | .129    | 78.6                          | 89.0                                          | 71.4 | 17.6  |
| 5     | .806                                            | .879                                      | .725    | .154    | 82.1                          | 93.0                                          | 72.8 | 20.2  |
| 6     | .738                                            | .834                                      | .620    | .214    | 83.9                          | 95.0                                          | 78.2 | 16.8  |
| 7     | .695                                            | .772                                      | .617    | .155    | 85.6                          | 96.8                                          | 77.2 | 19.6  |
| 8     | .688                                            | .760                                      | .621    | .139    | 86.6                          | 97.6                                          | 78.0 | 19.6  |
| 9     | .707                                            | .794                                      | .629    | .165    | 88.2                          | 98.8                                          | 81.0 | 17.8  |
| 10    | .655                                            | .730                                      | .562    | .168    | 89.3                          | 102.6                                         | 81.8 | 20.8  |
| 11    | .615                                            | .685                                      | .545    | .140    | 89.1                          | 102.3                                         | 78.8 | 23.5  |
| 12    | .642                                            | .709                                      | .576    | .133    | 88.1                          | 106.2                                         | 77.4 | 22.8  |
| 13    | .730                                            | .810                                      | .671    | .139    | 87.7                          | 100.2                                         | 77.0 | 23.2  |
| 14    | .716                                            | .799                                      | .634    | .165    | 88.5                          | 101.8                                         | 79.2 | 22.6  |
| 15    | .674                                            | .747                                      | .581    | .166    | 88.8                          | 102.6                                         | 80.6 | 22.0  |
| 16    | .676                                            | .736                                      | .630    | .106    | 86.3                          | 93.8                                          | 80.7 | 13.1  |
| 17    | .700                                            | .766                                      | .642    | .124    | 85.3                          | 90.8                                          | 81.4 | 9.4   |
| 18    | .723                                            | .796                                      | .618    | .178    | 85.1                          | 92.1                                          | 80.8 | 11.3  |
| 19    | .734                                            | .812                                      | .679    | .133    | 86.4                          | 95.6                                          | 81.2 | 14.4  |
| 20    | .803                                            | .894                                      | .732    | .162    | 86.8                          | 94.0                                          | 81.4 | 12.6  |
| 21    | .914                                            | 30.062                                    | .806    | .256    | 82.4                          | 91.4                                          | 69.6 | 21.8  |
| 22    | .983                                            | .074                                      | .899    | .175    | 75.5                          | 84.4                                          | 68.4 | 16.0  |
| 23    | .951                                            | .039                                      | .845    | .194    | 79.3                          | 88.2                                          | 73.0 | 15.2  |
| 24    | .902                                            | 29.973                                    | .804    | .169    | 82.5                          | 91.2                                          | 75.0 | 16.2  |
| 25    | .835                                            | .917                                      | .721    | .196    | 83.6                          | 94.2                                          | 75.7 | 18.5  |
| 26    | .766                                            | .853                                      | .660    | .193    | 85.7                          | 96.4                                          | 77.4 | 19.0  |
| 27    | .796                                            | .858                                      | .731    | .127    | 86.1                          | 94.4                                          | 77.8 | 16.6  |
| 28    | .853                                            | .995                                      | .788    | .207    | 80.3                          | 89.8                                          | 72.2 | 17.6  |
| 29    | .874                                            | .959                                      | .792    | .167    | 78.2                          | 87.0                                          | 73.0 | 14.0  |
| 30    | .839                                            | .900                                      | .751    | .149    | 81.0                          | 90.6                                          | 72.0 | 18.6  |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of April 1866.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Date. | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>vapour. | Mean Weight of Vapour<br>in a Cubic foot of air. | Additional Weight of<br>Vapour required for<br>complete saturation. | Mean degree of Humi-<br>dity complete satu-<br>ration being unity. |
|-------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|---------------------------------------------------------------------|--------------------------------------------------------------------|
|       | °                               | °                   | °                   | °                            | Inches.                          | T. gr.                                           | T. gr.                                                              |                                                                    |
| 1     | 75.1                            | 7.4                 | 69.9                | 12.6                         | 0.725                            | 7.77                                             | 3.87                                                                | 0.67                                                               |
| 2     | 75.1                            | 7.5                 | 69.8                | 12.8                         | .722                             | .74                                              | .94                                                                 | .66                                                                |
| 3     | 71.1                            | 6.3                 | 66.7                | 10.7                         | .653                             | .07                                              | 2.94                                                                | .71                                                                |
| 4     | 69.9                            | 8.7                 | 63.8                | 14.8                         | .593                             | 6.41                                             | 3.97                                                                | .62                                                                |
| 5     | 73.2                            | 8.9                 | 67.0                | 15.1                         | .659                             | 7.08                                             | 4.43                                                                | .62                                                                |
| 6     | 77.3                            | 6.6                 | 72.7                | 11.2                         | .792                             | 8.49                                             | 3.64                                                                | .70                                                                |
| 7     | 75.2                            | 10.4                | 67.9                | 17.7                         | .679                             | 7.24                                             | 5.52                                                                | .57                                                                |
| 8     | 79.2                            | 7.4                 | 74.8                | 11.8                         | .849                             | 9.04                                             | 4.10                                                                | .69                                                                |
| 9     | 81.2                            | 7.0                 | 77.0                | 11.2                         | .910                             | .67                                              | .09                                                                 | .70                                                                |
| 10    | 80.4                            | 8.9                 | 75.1                | 14.2                         | .857                             | .08                                              | 5.13                                                                | .64                                                                |
| 11    | 76.7                            | 12.4                | 69.3                | 19.8                         | .711                             | 7.52                                             | 6.60                                                                | .53                                                                |
| 12    | 75.3                            | 12.8                | 67.6                | 20.5                         | .672                             | .13                                              | .59                                                                 | .52                                                                |
| 13    | 77.6                            | 10.1                | 71.5                | 16.2                         | .763                             | 8.11                                             | 5.45                                                                | .60                                                                |
| 14    | 78.2                            | 10.3                | 72.0                | 16.5                         | .776                             | .21                                              | .67                                                                 | .59                                                                |
| 15    | 79.8                            | 9.0                 | 74.4                | 14.4                         | .838                             | .89                                              | .11                                                                 | .64                                                                |
| 16    | 80.7                            | 5.6                 | 76.8                | 9.5                          | .905                             | 9.63                                             | 3.39                                                                | .74                                                                |
| 17    | 79.7                            | 5.6                 | 75.8                | 9.5                          | .876                             | .35                                              | .29                                                                 | .74                                                                |
| 18    | 79.7                            | 5.4                 | 75.9                | 9.2                          | .879                             | .40                                              | .17                                                                 | .75                                                                |
| 19    | 80.1                            | 6.3                 | 75.7                | 10.7                         | .873                             | .30                                              | .76                                                                 | .71                                                                |
| 20    | 80.4                            | 6.4                 | 76.6                | 10.2                         | .899                             | .57                                              | .64                                                                 | .72                                                                |
| 21    | 76.2                            | 6.2                 | 71.9                | 10.5                         | .773                             | 8.29                                             | .32                                                                 | .71                                                                |
| 22    | 70.7                            | 4.8                 | 67.3                | 8.2                          | .666                             | 7.25                                             | 2.21                                                                | .77                                                                |
| 23    | 74.6                            | 4.7                 | 71.3                | 8.0                          | .758                             | 8.20                                             | .39                                                                 | .77                                                                |
| 24    | 76.1                            | 6.4                 | 71.6                | 10.9                         | .766                             | .22                                              | 3.42                                                                | .71                                                                |
| 25    | 78.0                            | 5.6                 | 74.1                | 9.5                          | .830                             | .89                                              | .14                                                                 | .74                                                                |
| 26    | 78.7                            | 7.0                 | 73.8                | 11.9                         | .822                             | .76                                              | 4.04                                                                | .68                                                                |
| 27    | 80.6                            | 5.5                 | 76.7                | 9.4                          | .902                             | 9.62                                             | 3.39                                                                | .74                                                                |
| 28    | 76.3                            | 4.0                 | 73.5                | 6.8                          | .814                             | 8.78                                             | 2.13                                                                | .81                                                                |
| 29    | 74.0                            | 4.2                 | 71.1                | 7.1                          | .753                             | .16                                              | .09                                                                 | .80                                                                |
| 30    | 74.1                            | 6.9                 | 69.3                | 11.7                         | .711                             | 7.64                                             | 3.50                                                                | .69                                                                |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations*

*taken at the Surveyor General's Office, Calcutta;*

*in the month of April 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

| Hour.      | Mean Height of the Barometer at 32° Fahr. | Range of the Barometer for each hour during the month. |         |         | Mean Dry Bulb Thermometer. | Range of the Temperature for each hour during the month. |      |       |
|------------|-------------------------------------------|--------------------------------------------------------|---------|---------|----------------------------|----------------------------------------------------------|------|-------|
|            |                                           | Max.                                                   | Min.    | Diff.   |                            | Max.                                                     | Min. | Diff. |
|            | Inches.                                   | Inches.                                                | Inches. | Inches. | °                          | °                                                        | °    | °     |
| Mid-night. | 29.783                                    | 30.042                                                 | 29.623  | 0.419   | 79.5                       | 83.4                                                     | 68.8 | 14.6  |
| 1          | .771                                      | 29.963                                                 | .608    | .355    | 79.0                       | 83.0                                                     | 68.4 | 14.6  |
| 2          | .761                                      | .982                                                   | .593    | .389    | 78.8                       | 82.6                                                     | 68.8 | 13.8  |
| 3          | .752                                      | .959                                                   | .580    | .379    | 78.5                       | 82.2                                                     | 68.4 | 13.8  |
| 4          | .755                                      | .960                                                   | .587    | .373    | 78.2                       | 82.0                                                     | 69.0 | 13.0  |
| 5          | .770                                      | .982                                                   | .600    | .382    | 78.0                       | 82.2                                                     | 69.0 | 13.2  |
| 6          | .790                                      | 30.005                                                 | .620    | .385    | 77.8                       | 82.2                                                     | 68.6 | 13.6  |
| 7          | .811                                      | .038                                                   | .640    | .398    | 78.8                       | 83.4                                                     | 70.4 | 13.0  |
| 8          | .833                                      | .068                                                   | .665    | .403    | 81.2                       | 85.8                                                     | 70.7 | 15.1  |
| 9          | .849                                      | .074                                                   | .684    | .390    | 84.3                       | 88.8                                                     | 73.3 | 15.5  |
| 10         | .851                                      | .070                                                   | .685    | .385    | 86.9                       | 92.2                                                     | 75.0 | 17.2  |
| 11         | .841                                      | .014                                                   | .683    | .331    | 89.1                       | 95.6                                                     | 76.3 | 19.3  |
| Noon.      | .822                                      | .007                                                   | .662    | .345    | 90.6                       | 98.9                                                     | 77.6 | 21.3  |
| 1          | .791                                      | 29.971                                                 | .627    | .344    | 91.9                       | 100.2                                                    | 78.0 | 22.2  |
| 2          | .757                                      | .947                                                   | .585    | .362    | 92.7                       | 101.8                                                    | 82.0 | 19.8  |
| 3          | .729                                      | .918                                                   | .565    | .353    | 93.0                       | 102.3                                                    | 82.8 | 19.5  |
| 4          | .709                                      | .899                                                   | .555    | .344    | 92.4                       | 102.6                                                    | 81.0 | 21.6  |
| 5          | .705                                      | .905                                                   | .545    | .360    | 90.6                       | 100.8                                                    | 79.0 | 21.8  |
| 6          | .727                                      | .917                                                   | .557    | .360    | 87.7                       | 96.4                                                     | 77.2 | 19.2  |
| 7          | .741                                      | .948                                                   | .577    | .371    | 84.7                       | 91.6                                                     | 72.8 | 18.8  |
| 8          | .768                                      | .963                                                   | .605    | .358    | 82.6                       | 89.8                                                     | 73.6 | 16.2  |
| 9          | .783                                      | .989                                                   | .632    | .357    | 81.6                       | 87.0                                                     | 73.4 | 13.6  |
| 10         | .796                                      | 30.016                                                 | .641    | .375    | 80.6                       | 85.0                                                     | 72.2 | 12.8  |
| 11         | .795                                      | .062                                                   | .639    | .423    | 80.0                       | 84.4                                                     | 73.3 | 11.1  |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.



*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of April 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Hour.          | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>Vapour. | Mean Weight of Vapour<br>in a Cubic foot of air. | Additional Weight of<br>Vapour required for<br>complete saturation. | Mean degree of Humi-<br>dity, complete satura-<br>tion being unity. |
|----------------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
|                | °                               | °                   | °                   | °                            | Inches.                          | T. gr.                                           | T. gr.                                                              |                                                                     |
| Mid-<br>night. | 76.1                            | 3.4                 | 73.7                | 5.8                          | 0.819                            | 8.85                                             | 1.81                                                                | 0.83                                                                |
| 1              | 76.0                            | 3.0                 | 73.9                | 5.1                          | .824                             | .92                                              | .58                                                                 | .85                                                                 |
| 2              | 76.1                            | 2.7                 | 74.2                | 4.6                          | .832                             | 9.00                                             | .44                                                                 | .86                                                                 |
| 3              | 76.1                            | 2.4                 | 74.4                | 4.1                          | .838                             | .08                                              | .27                                                                 | .88                                                                 |
| 4              | 76.0                            | 2.2                 | 74.5                | 3.7                          | .840                             | .11                                              | .14                                                                 | .89                                                                 |
| 5              | 75.9                            | 2.2                 | 74.3                | 3.7                          | .835                             | .05                                              | .14                                                                 | .89                                                                 |
| 6              | 75.8                            | 2.0                 | 74.4                | 3.4                          | .838                             | .10                                              | .03                                                                 | .90                                                                 |
| 7              | 76.3                            | 2.5                 | 74.5                | 4.3                          | .840                             | .11                                              | .33                                                                 | .87                                                                 |
| 8              | 77.2                            | 4.0                 | 74.4                | 6.8                          | .838                             | .02                                              | 2.19                                                                | .81                                                                 |
| 9              | 77.8                            | 6.5                 | 73.2                | 11.1                         | .806                             | 8.63                                             | 3.65                                                                | .70                                                                 |
| 10             | 78.1                            | 8.8                 | 72.8                | 14.1                         | .795                             | .47                                              | 4.78                                                                | .64                                                                 |
| 11             | 78.1                            | 11.0                | 71.5                | 17.6                         | .763                             | .08                                              | 6.04                                                                | .57                                                                 |
| Noon.          | 77.7                            | 12.9                | 70.0                | 20.6                         | .727                             | 7.66                                             | 7.10                                                                | .52                                                                 |
| 1              | 77.9                            | 14.0                | 69.5                | 22.4                         | .715                             | .53                                              | .79                                                                 | .49                                                                 |
| 2              | 77.7                            | 15.0                | 68.7                | 24.0                         | .697                             | .32                                              | 8.36                                                                | .47                                                                 |
| 3              | 77.6                            | 15.4                | 68.4                | 24.6                         | .690                             | .25                                              | .56                                                                 | .46                                                                 |
| 4              | 77.4                            | 15.0                | 68.4                | 24.0                         | .690                             | .25                                              | .29                                                                 | .47                                                                 |
| 5              | 77.3                            | 13.3                | 69.3                | 21.3                         | .711                             | .50                                              | 7.26                                                                | .51                                                                 |
| 6              | 77.5                            | 10.2                | 71.4                | 16.3                         | .761                             | 8.08                                             | 5.48                                                                | .60                                                                 |
| 7              | 76.9                            | 7.8                 | 71.4                | 13.3                         | .761                             | .13                                              | 4.29                                                                | .66                                                                 |
| 8              | 76.7                            | 5.9                 | 72.6                | 10.0                         | .790                             | .49                                              | 3.19                                                                | .73                                                                 |
| 9              | 76.5                            | 5.1                 | 72.9                | 8.7                          | .797                             | .57                                              | 2.77                                                                | .76                                                                 |
| 10             | 76.3                            | 4.3                 | 73.3                | 7.3                          | .809                             | .72                                              | .29                                                                 | .79                                                                 |
| 11             | 76.1                            | 3.9                 | 73.4                | 6.6                          | .811                             | .75                                              | 3.06                                                                | .81                                                                 |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of April 1866.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | Max. Pressure of Wind. | General Aspect of the Sky.                                                                                                                             |
|-------|-----------------------|---------------------------------|-----------------------------------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
|       | °                     | Inches                          |                                   | lb                     |                                                                                                                                                        |
| 1     | 132.0                 | ...                             | W. S. W. & E. S. E.               | 2.75                   | Overcast to Noon, $\searrow$ i to 5 P. M., clear afterwards.                                                                                           |
| 2     | 141.0                 | ...                             | S. S. E. & W. S. W.               | 1.25                   | $\searrow$ i to 7 A. M., scatd. $\nearrow$ i to 4 P. M., overcast to 8 P. M. $\searrow$ i afterwards.                                                  |
| 3     | 121.5                 | ...                             | N. & N. N. W.                     | 2.25                   | $\searrow$ i to 3 P. M., overcast afterwards. Thin rain between 6 & 7 A. M. & at 8 & 10 P. M.                                                          |
| 4     | 128.0                 | ...                             | W. S. W.                          | 0.25                   | $\searrow$ i to 5 A. M., $\nearrow$ i to Noon, clear afterwards.                                                                                       |
| 5     | 135.0                 | ...                             | W. S. W. & S. S. W.               | ...                    | Clear to 11 A. M., scatd. $\nearrow$ i to 5 P. M., clear afterwards.                                                                                   |
| 6     | 132.0                 | ...                             | S. S. W. & S. W.                  | 2.25                   | Clear to 7 A. M., scatd. $\nearrow$ i to 7 P. M. clear afterwards, lightning to the S. at 10 & 11 P. M.                                                |
| 7     | 141.0                 | ...                             | S. W. & W. N. W.                  | 0.50                   | Clear scuds, from S. W. from 4 to 7 A. M. Foggy at 6 A. M.                                                                                             |
| 8     | 145.6                 | ...                             | S. & W. S. W.                     | 0.25                   | Clear to 10 A. M. Scatd. $\nearrow$ i to 5 P. M., clear afterwards.                                                                                    |
| 9     | 140.0                 | ...                             | S. by E. & S.                     | ...                    | Scuds from S. to N. to 9 A. M. clear afterwards.                                                                                                       |
| 10    | 143.0                 | ...                             | S. & S. S. W.                     | ...                    | Scuds from S. W. to N. E. to 8 A. M. clear afterwards.                                                                                                 |
| 11    | 144.6                 | ...                             | S. & N. W.                        | ...                    | Clear.                                                                                                                                                 |
| 12    | 140.5                 | ...                             | S. & variable                     | 0.50                   | Clear. Foggy at 6 & 7 A. M.                                                                                                                            |
| 13    | 145.5                 | ...                             | S. & variable                     | 0.50                   | Clear. Foggy from 5 to 7 A. M.                                                                                                                         |
| 14    | 140.5                 | ...                             | S. & W.                           | 0.75                   | Clear.                                                                                                                                                 |
| 15    | 148.4                 | ...                             | S. S. W. & S. by E.               | ...                    | Clear to 3 A. M. Scatd. clouds to 8 A. M., clear afterwards.                                                                                           |
| 16    | 132.4                 | ...                             | S. & S. S. W. (high)              | 2.00                   | Clear to 9 A. M. Scuds from S. to N. to 3 P. M. clear afterwards.                                                                                      |
| 17    | 122.0                 | ...                             | S. (high)                         | 4.50                   | Clear to 4 A. M. Scuds from S. to N. to 3 P. M. Overcast to 7 P. M. clear afterwards, lightning to the S. at 7 & 8 A. M. thin rain between 4 & 5 A. M. |
| 18    | 128.7                 | ...                             | S. S. W. & S.                     | 3.25                   | Clouds of different kinds.                                                                                                                             |
| 19    | 130.2                 | ...                             | S. & S. S. W. & S. by W.          | 2.00                   | Clouds of different kinds to 6 P. M., clear afterwards. Lightning to the S. E. at 4 A. M.                                                              |
| 20    | 138.0                 | ...                             | S. & S. S. W.                     | 1.80                   | Clouds of different kinds. Lightning to the E.                                                                                                         |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of April 1866.*

## Solar Radiation, Weather, &amp;c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | Max. Pressure of Wind. | General Aspect of the Sky.                                                                                                                               |
|-------|-----------------------|---------------------------------|-----------------------------------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
|       | °                     | Inches                          |                                   | lb                     |                                                                                                                                                          |
| 21    | .....                 | * 0.51                          | S. & S. S. E.                     | 10.50                  | Overcast Lightning Thunder & rain at 10 & 11 P. M. Hails at 10 P. M.                                                                                     |
| 22    | 123.2                 |                                 | S. E. & variable                  | 2.00                   | Overcast to Noon & i afterwards, Lightning & Thunder at Midnight light rain at Midnight, 1 & from 4 to 6 A. M.                                           |
| 23    | 128.0                 | 0.14                            | S. W. & N. N. W.                  | 2.80                   | i & i to 6 P. M. clear afterwards. Lightning to S. at 9 P. M. Rain at 4 & 5 P. M.                                                                        |
| 24    | 135.8                 | ...                             | E. S. E. & variable.              | 1.00                   | Overcast to 3 A. M. clear to 9 A. M. Scatd. i to 6 P. M. clear afterwards, Lightning to S. W. at 1 A. M.                                                 |
| 25    | 132.0                 | *                               | E. & S. S. W.                     | 1.00                   | Clear to 6 A. M. Scatd. i to 4 P. M. clear afterwards.                                                                                                   |
| 26    | 128.5                 | ...                             | S. S. W. & S.                     | 1.25                   | Clear to 1 P. M. i afterwards Lightning to the W. & S. at 7 & 8 P. M. Thunder at 7 P. M. Light rain between 7 & 8 P. M.                                  |
| 27    | 131.6                 | ...                             | S. S. E. & S.                     | 1.00                   | i to A. M. Scuds from S. to 10 A. M. i to 4 P. M. clear afterwards.                                                                                      |
| 28    | .....                 | 1.16                            | S. E. & E.                        | 2.75                   | Clear to 7 A. M. Scuds from S. to 10 A. M. Overcast afterwards Lightning to the E. from 6 to 9 P. M. Thunder at 5 & 6 P. M. rain at Noon, 5, 6 & 8 P. M. |
| 29    | 128.0                 | ...                             | W. & variable.                    | 2.00                   | Scatd. i to 5 A. M. i & i to 1 P. M. overcast afterwards Lightning to the E. at 8 & 9 P. M. Thin rain at 6 P. M.                                         |
| 30    | 131.0                 | ...                             | S. W. & N. N. E.                  | 5.00                   | Scatd. i & i to 1 P. M. Scatd i to 5 P. M. overcast afterwards Lightning to the S. W. at 9 P. M. Thin rain at 10 & 11 P. M.                              |

i Cirri, — i Strati, i Cumuli, i Cirro-strati, i Cumulo strati, i Nimbi, i Cirro cumuli.

\* Fell from 10 P. M. of the 21st to 6 A. M. of the 22nd.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta, in the  
month of April 1866.*

MONTHLY RESULTS.

|                                                                   | Inches. |
|-------------------------------------------------------------------|---------|
| Mean height of the Barometer for the month, ...                   | 29.779  |
| Max. height of the Barometer occurred at 9 A. M. on the 22nd, ... | 30.074  |
| Min. height of the Barometer occurred at 5 P. M. on the 11th, ... | 29.545  |
| Extreme range of the Barometer during the month, ..               | 0.529   |
| Mean of the daily Max. Pressures, ... ..                          | 29.863  |
| Ditto ditto Min. ditto ... ..                                     | 29.700  |
| Mean daily range of the Barometer during the month, ...           | 0.163   |

|                                                          |       |
|----------------------------------------------------------|-------|
| Mean Dry Bulb Thermometer for the month, ...             | 84.1  |
| Max. Temperature occurred at 4 P. M. on the 10th & 15th  | 102.6 |
| Min. Temperature occurred at 1 & 3 A. M. on the 22nd     | 68.4  |
| Extreme range of the Temperature during the month,       | 34.2  |
| Mean of the daily Max. Temperature ... ..                | 94.0  |
| Ditto ditto Min. ditto, ... ..                           | 76.7  |
| Mean daily range of the Temperature during the month,... | 17.3  |

|                                                              |      |
|--------------------------------------------------------------|------|
| Mean Wet Bulb Thermometer for the month, ... ..              | 76.9 |
| Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer,   | 7.2  |
| Computed Mean Dew-point for the month, ... ..                | 71.9 |
| Mean Dry Bulb Thermometer above computed mean Dew-point. ... | 12.2 |

|                                             | Inches. |
|---------------------------------------------|---------|
| Mean Elastic force of Vapour for the month, | 0.773   |

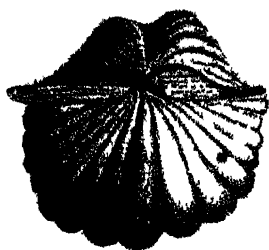
|                                                                             | Troy grains. |
|-----------------------------------------------------------------------------|--------------|
| Mean Weight of Vapour for the month ... ..                                  | 8.28         |
| Additional Weight of Vapour required for complete saturation, ...           | 3.93         |
| Mean degree of humidity for the month, complete saturation being unity 0.68 |              |

|                                                                                                      | Inches. |
|------------------------------------------------------------------------------------------------------|---------|
| Rained 9 days.—Max. fall of rain during 24 hours ... ..                                              | 1.16    |
| Total amount of rain during the month, ... ..                                                        | 1.81    |
| Total amount of rain indicated by the Gauge attached to the anemo-<br>meter during the month, ... .. | 1.37    |
| Prevailing direction of the Wind, ... S. & S. S. W. & W. S. W.                                       |         |

MONTHLY RESULTS.

Tables showing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.

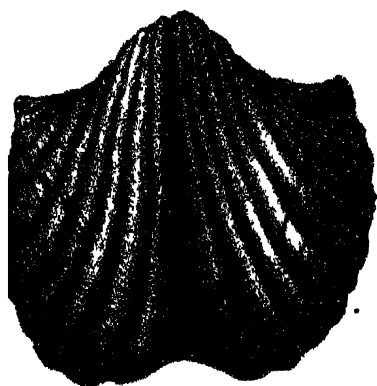
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1 a



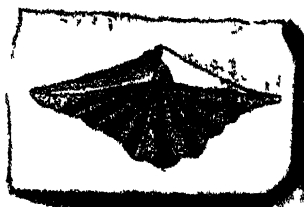
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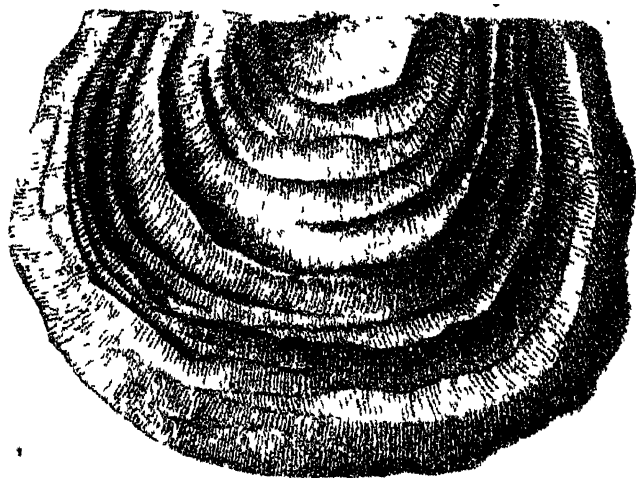
1 c



2 a

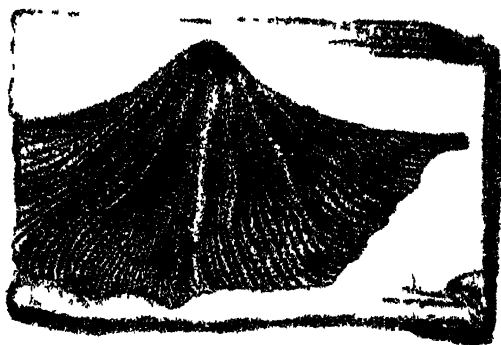




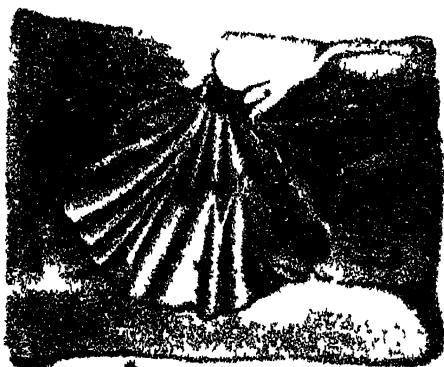








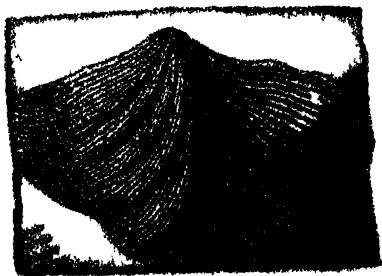
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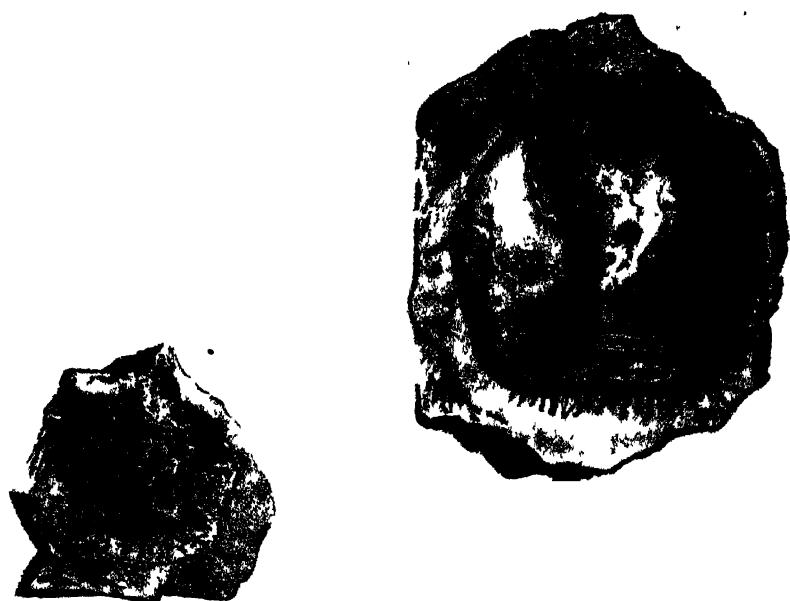
2



3



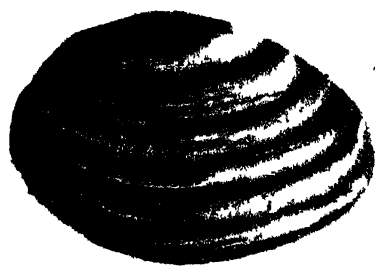


















2



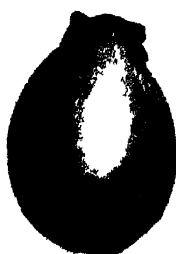
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3



1 b

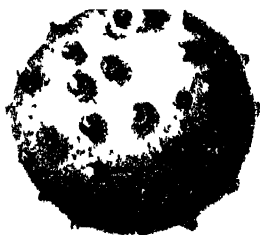


4 3

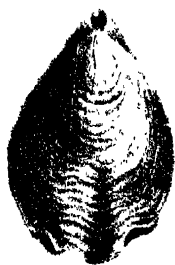


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2. 10



2. 11



# JOURNAL OF THE ASIATIC SOCIETY.

PART II.—PHYSICAL SCIENCE.

No. III.—1867.

*On the Reproductive Functional Relations of several Species and Varieties of Verbasca.*

By John Scott, Esq.,

Curator of the Royal Botanical Gardens, Calcutta.

In this paper, I purpose giving an account of a numerous and carefully performed series of experiments on the hybrid and cross-unions of several species and varieties of *Verbasca*, with the view of illustrating those functional relations, or differences existing between the results of unions of distinct species on the one hand, with those of different varieties of the same species on the other. I believe, the generally accepted view of naturalists on this point is, that a certain degree of sterility always results from the union of distinct species in their first hybrid produce, and that their progeny are absolutely infertile, one with another; while in the cross-unions of varieties of a species, the fertility is in no respect affected in the first cross, and the progeny are, in every case, perfectly fertile, one with another. These relative differences, then, in the products of hybridism and mongrelism are strongly maintained to be decisively demarcative of the factors, included under the terms "species" and "varieties," affording, so to speak, an unequivocal analysis, whereby nature's original and immu-

table units—species—may at once be discriminated from those diverged forms—varieties—to which they have given rise, and with which, from the important structural differences they frequently assume, they might be hopelessly confounded. Such, at least, is the opinion of those naturalists who regard species as the result of distinct creative acts. On the other hand, those naturalists who believe in derivative hypotheses, and look upon all existing organisms as the genealogical connections of other and earlier kinds, entertain the directly opposite view, and maintain that no such essential differences as those above stated exist between the results of hybridism and mongrelism; though they readily admit a difference in degree. This point has been ably and philosophically discussed by Mr. Darwin, who, after a careful and impartial examination of all the evidence he could collate, considers himself justified in concluding, that “first crosses between forms known to be varieties, or sufficiently alike to be considered as varieties, and their mongrel offspring, are very generally, but not, as is so often falsely stated, universally fertile.....consequently that neither fertility nor sterility afford any clear distinction between species and varieties; but that the evidence from this source graduates away, and is doubtful in the same degree, as is the evidence derived from other constitutional and structural differences.”\*

Though Mr. Darwin thus clearly anticipates an essential accordance between the result of hybridism and mongrelism, it is to be observed that the extreme paucity of experimental observations on the latter phenomena prevents his illustrating the subject so fully and satisfactorily as its importance demands. The want of such observations, and the importance of their bearing on that theory of the “origin of species” proposed by Mr. Darwin, has been frequently and strongly insisted on by Professor Huxley. Thus in his “*Essay on Man's Place in Nature*,” p. 106, we find the following remarks: “Our acceptance of the Darwinian hypothesis must be provisional so long as one link in the chain of evidence is wanting, and so long as all the animals and plants certainly produced by selective breeding from a common stock are fertile, and their progeny are fertile one with another, that link will be wanting.” Again in his *Lectures on our knowledge of the cause of the phenomena of organic nature*, Lecture VI. p. 147, after

\* Darwin's “*Origin of Species*,” 3rd Edition, pp. 271 and 300.

discussing the obligations of a hypothesis, he remarks, that "Mr. Darwin, in order to place his views beyond the reach of all possible doubt, ought to be able to demonstrate the possibility of developing from a particular stock, by selective breeding, two forms which should either be unable to cross one with another, or whose cross-bred offspring should be infertile with one another," ..... "Now it is admitted on all hands that at present so far as experiments have gone, it has not been found possible to produce their complete physiological divergence by selective breeding,..... If it should be proved, not only that this has not been done, but that it could not be done, I hold that Mr. Darwin's hypothesis would be utterly shattered." Professor Huxley, however, though thus strongly insisting upon the absence of facts showing that any degree of sterility has resulted from the crossing of varieties known to have originated from a common stock, states that he does not know a single fact which would justify the assertion that such sterility could not be produced by proper experiment, expressing his belief that it may and will be produced.

Considering then the as yet positively equivocal nature of the relations between the phenomena of hybridism and mongrelism, together with its important bearings on the converse theories which now divide the scientific world, I trust the reader will bear with me, while giving a somewhat detailed statement of my own experiments on the above phenomena. I venture to premise that they show pretty clearly the relative claims of the two views now held by naturalists on our acceptance, and illustrate also one or two other points of high interest in theoretical natural science. First, for the union of *V. phæniceum* vars. *roseum* and *album* and *V. nigrum*.

| No. | TABLE 1.—Results of Pure and Mixed Unions of <i>Verbascum phæniceum</i> , var. <i>roseum</i> and <i>album</i> ; and <i>V. nigrum</i> . | No. of flowers fertilized. | Capsules produced. | Seeds produced. | Average of seeds per capsule. | By calculation. |        |
|-----|----------------------------------------------------------------------------------------------------------------------------------------|----------------------------|--------------------|-----------------|-------------------------------|-----------------|--------|
|     |                                                                                                                                        |                            |                    |                 |                               | Capsules.       | Seeds. |
| 1.  | <i>Verbascum phæniceum</i> by pollen of <i>V. phæniceum roseum</i> , ... ..                                                            | 10                         | 8                  | 193             | 24                            | 20              | 483    |
| 2.  | <i>V. phæniceum, roseum</i> by pollen of <i>V. phæniceum</i> , ... ..                                                                  | 12                         | 9                  | 306             | 34                            | 20              | 680    |

TABLE 1, (Contd.)—Results of Pure and Mixed Unions of *Verbascum phæniceum*, var. *roseum* and *album*; and *V. nigrum*.

| No. |                                                                               | No. of flowers ferti-<br>lised. | Capsules produced. | Seeds produced. | Average of seeds per<br>capsule. | By cal-<br>culation. |        |
|-----|-------------------------------------------------------------------------------|---------------------------------|--------------------|-----------------|----------------------------------|----------------------|--------|
|     |                                                                               |                                 |                    |                 |                                  | Capsules.            | Seeds. |
| 3.  | <i>V. phæniceum</i> , by pollen of <i>V. phæni-<br/>ceum, album</i> , ...     | 10                              | 6                  | 120             | 20                               | 20                   | 400    |
| 4.  | <i>V. phæniceum, album</i> by pollen of <i>V.<br/>phæniceum</i> , ...         | 16                              | 11                 | 287             | 26                               | 20                   | 522    |
| 5.  | <i>V. phæniceum, album</i> by pollen of <i>V.<br/>phæniceum, roseum</i> , ... | 8                               | 4                  | 116             | 29                               | 20                   | 580    |
| 6.  | <i>V. phæniceum, roseum</i> by pollen of <i>V.<br/>phæniceum, album</i> , ... | 8                               | 0                  | ...             | ...                              | ...                  | ...    |
| 7.  | <i>V. phæniceum</i> , by pollen of <i>V. nigrum</i> , ...                     | 10                              | 3                  | 57              | 19                               | 20                   | 380    |
| 8.  | <i>V. phæniceum, album</i> by pollen of <i>V.<br/>nigrum</i> , ...            | 10                              | 6                  | 110             | 18                               | 20                   | 367    |
| 9.  | <i>V. phæniceum, roseum</i> by pollen of <i>V.<br/>nigrum</i> , ...           | 10                              | 7                  | 107             | 15                               | 20                   | 306    |
| 10. | <i>V. phæniceum</i> , by own pollen, ...                                      | 18                              | 0                  | ...             | ...                              | ...                  | ...    |
| 11. | <i>V. phæniceum, roseum</i> by own pollen, ...                                | 18                              | 0                  | ...             | ...                              | ...                  | ...    |
| 12. | <i>V. phæniceum, album</i> by own pollen, ..                                  | 18                              | 0                  | ...             | ...                              | ...                  | ...    |

The following descriptive notice of the plants in Tab. 1, will show their close morphological relations. First, *V. phæniceum*; stem somewhat downy, simple, producing upwards a racemose panicle. Leaves crenate, oblong-ovate, nearly glabrous above, deep green. Radical subcordate, ovately-acuminate, petiolate. Upper cauline crenulated, semi-amplexicaul. Bractees lanceolate. Raceme elongated. Flowers lax, solitary; pedicels longer than the bractees. Corolla purplish-violet, beset with violet hairs at its base. Stamens; filaments of the three shorter stamens covered with long glandular purplish hairs, these of the two longer naked, except on the upper side, where there are a few similarly characterised hairs. Anthers of the three longer stamens nearly circular, and covered with purple and white glandulose hairs, these of the shorter stamens, reniform and nearly naked. Pollen copper-coloured. Second, *V. phæniceum, roseum* differs from the above only in the less elongated raceme and the rose-coloured flowers. Third, *V. phæniceum, album* is of a more robust habit than the other two.

*Radical leaves* ovate-lanceolate, light green. *Flowers* white and rather larger than the others, with a few whitish glandulose hairs near the base of petals. *Filaments* and form of *anthers* similar to these of *V. phæniceum*, but beset with white instead of purple, glandular hairs. *Pollen* similarly copper-coloured in each.

Thus, judging from the characters of these three forms alone, there can be no doubt as to their being other than conspecific. In addition to this I may add, on the authority of Mr. Stirling of Edinburgh, that they have been raised from pure seed of the *V. phæniceum*, the rose-coloured variety frequently appearing amongst the seedlings of *V. phæniceum*, the white presenting itself more rarely.

In the first part of Tab. 1, the number of flowers fertilised, and the simple results are shown, and in the right hand, for the sake of comparison, the calculated produce of the number of seeds from 20 capsules of each is given.\* If we compare the results, we see that reciprocal unions may be effected between the *V. phæniceum* and varieties, with one exception, viz., *V. phæniceum, roseum*, by pollen of *V. phæniceum, album*, in which case I have found that though the pollen tubes are abundantly developed and freely penetrate the stigmatic tissues, the capsules nevertheless drop prematurely. The goodness, however, of both the male and female elements of the above varieties is nevertheless shown by the reciprocal unions with *V. phæniceum*. The individual potency of the respective sexual elements of these varieties, in their reciprocal relations, is clearly shown; whereas by those experiments given in the three last lines of the table, in which the stigmas of each variety were covered by their own good pollen, no unions were effected, each proving utterly self-sterile!

This absolute, or conditional, sterility of the three varieties of *V. phæniceum*, when treated by their own good pollen, led me to examine

\* From Mr. Darwin's suggestion in "The Origin of species" that the decreased fertility of mixed unions, as compared with that of the pure unions, might possibly be increased by the fact, that for perfectly satisfactory results, castration is necessary in the cross-unions; whereas in the latter, in pure unions, this not being necessary, we may have indiscriminate comparisons, of the two results though clearly castration may have a direct sterilising influence. In view of this prudent suggestion, I took the precaution to castrate every flower both of the pure and mixed unions, from which I intended to draw results. The sole exception to this is that given in the first line of Table 2 of *V. phæniceum* as I was unable to get any of the plants under me to produce seed by their own pollen. Whatever be the effects of castration then on the fertility of the plants so treated, in the present cases, all having undergone it, the results will be mutual.



into the apparent cause, as in certain cases we find it arising from the non-emission or non-penetration of the pollen tubes ; the pollen through some mysterious cause being thus utterly impotent on its own stigma. The results of my present examination will, I trust, be found of sufficient interest to permit of my stating them here. They are as follows : first, I applied the pollen of each of the three varieties, reciprocally, to their stigmas ; on dissecting these, I found them abundantly permeated by pollen tubes, many of which I distinctly traced into the ovary. Secondly, I fertilised several flowers in each variety, with its own pollen ; on examining the stigmas of a few of these flowers, I found that many of the pollen grains had emitted tubes, but comparatively few had penetrated the stigmatic tissue, and of these still fewer permeated the conducting tissues of the styles. Several of the latter, however, I traced into the vascular bundles of the placenta, the pistillary cords, and in one or two instances, I believe that I detected them in the nucleus of the ovule. Nevertheless we have seen that, though these pollen tubes are developed, they most ineffectively perform their deputed function, inasmuch as not one of these matured even a single ovary ! I have here to observe, however, that these pollen tubes do not seem utterly void of the fecundative influence, as many of the ovaries did undergo a certain degree of development ; and on examination of these, as they dropped off, I found that the ovules also had undergone a partial and variable degree of development. In general, the fleshy albuminous envelope of the embryo was largely developed, whereas the embryo had undergone a very slight development, judging from a comparison of other good seeds of a similar stage, not at all proportionate to the size attained by the albuminous parts. In nearly all the embryos which came under my observation, the development had ceased ere they exhibited any distinct separation of parts ; a few only had reached that stage in which the axial and lateral projections were visible.

We thus see, that whatever be the real cause of the inveterate self-sterility of the three varieties of the *V. phæniceum*, it does not arise, as has been shown in other cases, from the non-emission of the pollen tubes. In these, as I have elsewhere noticed it, in certain individual plants of different species of *Oncidia*, *Maxillaria*, and *Passifloræ*, sterility apparently results from some slight differentiation of the male

element with respect to its own female element. I have also to remark, that the ultimate conditional sterility of these plants is not, relatively considered, an absolute but a graduated quantum; this is shown by the different degrees of development the embryos had undergone, thus illustrating a most interesting, though as yet imperfectly known fact, namely, that the male element, even though reaching the female element, may nevertheless fail to communicate that amount of vital stimulus necessary to the complete development of the embryo. Furthermore, I may in passing briefly refer to the perfect parallelism between these phenomena, and those occasionally observed in hybridisation, at least in the zoological kingdom, for unfortunately we are as yet nearly void of information on this point in the vegetable kingdom, hybridists having, in most instances, satisfied themselves by attending to the ultimate results, without troubling themselves to examine into the nature or degree of embryonic sterilisation. From the published papers of the Hon'ble and Rev. W. Herbert, we find, as might indeed be expected, that this point did not escape observation: thus in one case he remarks, "It has, I believe, not been duly considered, that the fecundation of the ovules is not a simple, but a complicated process. There seems to me to be three or four several processes: viz., the quickening of the capsule of the fruit, of the outer coats of the seed itself, of the internal parts or kernel, and lastly, the quickening of the embryo."..... "It is further to be observed," he continues, "that there is frequently an imperfect hybrid fertilisation, which can give life, but not sustain it well. I obtained much good seed from *Hibiscus palustris* by *H. speciosus*, and sowed a little each year till it was all gone, the plants always sprouted, but I saved only one to the third leaf, and it perished then."

To recur, however, to the above parallelism, of which we have here additional and important illustrations: it has been stated by Mr. Darwin\* on the authority of Mr. Hewitt, that in the hybridisation of gallinaceous birds a frequent cause of sterility in *first crosses* is the early death of the embryo. Again Mr. Salter records similar results from his experiments on the fertility *inter se* of several hybrid *Galli*,† thus concluding, "the one striking point of these experiments (which I believe has never been noticed before) is that a large proportion of

\* loc. cit. p. 286.

† Nat. Hist. Rev. 1868, p. 276.

these eggs from hybrid birds breeding *inter se* have failed to produce young, not from absolute sterility, but sterility in degree, from an amount of vitalization insufficient to carry out the whole result of reproduction, in which the young individual has been completed, leaving it with vital resistance insufficient to maintain life and cope with common and customary external influences." And thus in those curious cases of sterility of structurally hermaphrodite organisms, whose sexual elements have become differentiated with respect to their mutual fertile conjunctions, so in the phenomena of sterility from hybridism, we find, as Mr. Salter well remarks, with respect to the relations of hybridism and parthenogenesis, "that the sterility is not absolute but in degree, and that the stimulus, whatever it may be, which starts the embryonic changes is feeble and imperfect rather than wholly wanting."

I have now shown that a regular more or less early embryonic abortion results from the self-fertilisation of certain individual plants of *V. phæniceum* and *vars. roseum*, and *album*; whereas by their reciprocal fertilisation, highly fertile unions may in general be effected. By again consulting Table 1, however, it will be seen that besides a reciprocal fertilisation, these three plants are also susceptible of fertilisation by pollen of other species. Thus in lines 7, 8, 9, of Table 1, the male element of *V. nigrum* is singularly enough effective in the fertilisation of each, while in a succeeding Table—4—the goodness of the male elements is also similarly shown by each effectively fertilising the female element of the *V. lychnitis*, *lutea*. Again, we have fuller illustrations of these curious sexual phenomena in Table 2, in which one of the above plants, *V. phæniceum*, yields a varying degree of fertility to four other distinct species; namely the *V. ferrugineum*, *Blattaria lutea* and *alba*; *Lychnitis lutea* and *ovalifolia*. These are indeed remarkable physiological revelations. How strange that an individual plant could be fertilised by the pollen of five distinct species, and yet not by its own good pollen: how singular also, as shown above, to see three hermaphrodite individuals incapable of self-fertilisation, yet having each sexual element reciprocally meeting and fertilising the opposite elements of other species. Thus, for example, the male element of *V. phæniceum* and *vars. roseum* and *album* fertilise the female element of *V. lychnitis*, while the female elements of the three

former are also susceptible of fertilisation by the male element of *V. nigrum*. The full explanation of these curious and complicated sexual relations, I leave for more sagacious and ingenious investigators, and simply confine myself to remarking on the apparent support that these and more especially those other cases which I have communicated to the Linnean Society,\* on the fertilisation of certain species of *Passifloræ*,—in which I showed that individual plants perfectly self-sterile readily effected reciprocal unions with other similarly characterised individuals of the same species—give to that view which Mr. Darwin has propounded regarding the existence of a law in nature necessitating “an occasional cross with another individual, or, that no hermaphrodite fertilises itself for a perpetuity of generations,” but “that some unknown great good is derived from the union of individuals which have been kept distinct for many generations.”†

In the following table, the results of the pure unions of *V. phaniceum* given on the first line are taken from capsules on a specimen in the Edinburgh University Herbarium, as I have not yet been successful in getting good capsules from any of the plants which I have had an opportunity to experiment upon by their own pollen. The other plants of *V. phaniceum* and varieties mentioned in the table are the same as those from which I had the results given in Table 1. Indeed, in one or two instances, the same experiments are re-stated, with a view to show more clearly the relative degrees of sterility resulting from the crossing of undoubted varieties of a species on the one hand, with those from the hybridisation of distinct species on the other.

| TABLE 2.—Pure and Mixed Unions<br>of <i>Verbascum phaniceum</i> and<br>var. <i>as</i> ♀ |                                                                                 | No. of flowers ferti-<br>lised. | No. of capsules pro-<br>duced. | No. of seeds. | Average of seeds<br>per capsule. | By calcu-<br>lation. |               | The<br>comparative<br>fertility of<br>the different<br>unions. |
|-----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|---------------------------------|--------------------------------|---------------|----------------------------------|----------------------|---------------|----------------------------------------------------------------|
|                                                                                         |                                                                                 |                                 |                                |               |                                  | No. of<br>capsules.  | No. of seeds. |                                                                |
| No.                                                                                     |                                                                                 |                                 |                                |               |                                  |                      |               |                                                                |
| 1.                                                                                      | <i>Verbascum phaniceum</i> L.<br>(wild plant naturally ferti-<br>lised), ... .. | ..                              | 4                              | 142           | 36                               | 20                   | 710           | 1000                                                           |

\* “Journal Linn. Soc.” Vol. 8. p. 197.

† Orchid Fertilisation, pp. 1—360.

TABLE 2. *Contd.*—Pure and Mixed Unions of *Verbascum phæniceum* and var. as ♀

| No. |                                                                             | No. of flowers ferti-<br>lised. | No. of capsules pro-<br>duced. | No. of seeds. | Average of seeds per<br>capsule. | By calcu-<br>lation. |               | The<br>comparative<br>fertility of<br>the different<br>unions. |
|-----|-----------------------------------------------------------------------------|---------------------------------|--------------------------------|---------------|----------------------------------|----------------------|---------------|----------------------------------------------------------------|
|     |                                                                             |                                 |                                |               |                                  | No. of<br>capsules.  | No. of seeds. |                                                                |
| 2.  | <i>V. phæniceum</i> , rosea, by<br>pollen of <i>V. phæniceum</i> L.,        | 12                              | 9                              | 306           | 34                               | 20                   | 680           | 957.7                                                          |
| 3.  | <i>V. phæniceum</i> , alba, by<br>pollen of <i>V. phæniceum</i> ,<br>rosea, | 7                               | 5                              | 154           | 31                               | 20                   | 616           | 367.6                                                          |
| 4.  | <i>V. phæniceum</i> , alba by pollen<br>of <i>V. phæniceum</i> ,            | 16                              | 11                             | 287           | 26                               | 20                   | 522           | 735.2                                                          |
| 5.  | <i>V. phæniceum</i> , by pollen of<br><i>V. phæniceum</i> , rosea,          | 10                              | 8                              | 193           | 24                               | 20                   | 483           | 680.3                                                          |
| 6.  | <i>V. phæniceum</i> by pollen of<br><i>V. phæniceum</i> , alba,             | 10                              | 6                              | 120           | 20                               | 20                   | 400           | 563.4                                                          |
| 7.  | <i>V. phæniceum</i> by pollen of<br><i>V. ferrugineum</i> , Andr.,          | 12                              | 7                              | 148           | 21                               | 20                   | 423           | 595.8                                                          |
| 8.  | <i>V. phæniceum</i> by pollen of<br><i>V. blattaria</i> , lutea L.,         | 12                              | 7                              | 112           | 16                               | 20                   | 320           | 450.7                                                          |
| 9.  | <i>V. phæniceum</i> by pollen of<br><i>V. blattaria</i> , alba,             | 12                              | 4                              | 54            | 13                               | 20                   | 270           | 380.2                                                          |
| 10. | <i>V. phæniceum</i> by pollen of<br><i>V. lychnitis lutea</i> , L.,         | 12                              | 8                              | 102           | 13                               | 20                   | 255           | 359.1                                                          |
| 11. | <i>V. phæniceum</i> by pollen of<br><i>V. ovalifolium</i> , ..              | 12                              | 5                              | 43            | 8                                | 20                   | 172           | 242.2                                                          |

In addition to the simple and calculated results given on Table 1, I have, in the above, given at the right hand, for the sake of comparison, the calculated product from an assumed 1,000 seeds of the pure unions relatively to those yielded by the cross and hybrid unions. By a further comparative study of these results, we find that the fertility of the pure unions of *V. phæniceum*, relatively to that of its cross-unions with the white and rose-coloured varieties, is, in the least differentiated or most highly fertile unions, viz., *V. phæniceum*, rosea by pollen of *V. phæniceum*, as 100 : 95; whereas in the least fertile unions, *V. phæniceum* by pollen of *V. phæniceum*, alba, the proportions are as 100 : 56. The average fertility of the five cross-unions given in the table, relatively to the pure unions given in the first line, is as 100 : 75; so that the pure unions thus exceed in fertility the cross-unions, in nearly the proportions of, 4 : 3. Again

by a similar comparative study of the relative fertility of the pure unions of *V. phæniceum* and the different hybrid unions given in the Table, we find that the highest degree of fertility results from the union of *V. ferrugineum* (which perhaps is correctly regarded by De Candolle and others as a mere variety of *V. phæniceum*) with *V. phæniceum*, the proportions of the pure to the hybrid unions being as 100 : 59, in favour of the former. The lowest degree of fertility results from the unions of *V. ovalifolium*, with *V. phæniceum*, the proportion of the pure to the hybrid-unions in this case being as 100 : 24.) Lastly the average fertility of the five hybrid unions given in the latter lines of the Table, relatively to the pure unions of *V. phæniceum*, is nearly as 100 : 40, or as 2.5 seeds of the pure unions to one of the hybrid unions. Thus, the relative differences in the degree of sterilisation resulting from the hybridisation of distinct species, and that from the cross-impregnation of varieties of a species, relatively in either case to the pure unions, is in the former as 2.5 : 1, and in the latter as 4 : 3.

| TABLE 3.—Pure and Mixed Unions<br>of <i>V. lychnitis</i> , L. var. <i>alba</i><br>as ♀. |                                                                                                                 | No of flowers ferti-<br>lised. | No. of capsules pro-<br>duced. | No. of seeds. | Average of seeds<br>per capsule. | By calcula-<br>tion. |               | The<br>comparative<br>fertility of<br>the different<br>unions. |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|--------------------------------|--------------------------------|---------------|----------------------------------|----------------------|---------------|----------------------------------------------------------------|
|                                                                                         |                                                                                                                 |                                |                                |               |                                  | No. of<br>capsules.  | No. of seeds. |                                                                |
| No.                                                                                     |                                                                                                                 |                                |                                |               |                                  |                      |               |                                                                |
| 1.                                                                                      | <i>Verbascum lychnitis</i> , var.<br><i>alba</i> of gardens, by own<br>pollen, ..                               | 6                              | 6                              | 250           | 42                               | 20                   | 833           | 1000                                                           |
| 2.                                                                                      | <i>V. lychnitis</i> , <i>alba</i> , by pollen<br>of <i>V. lychnitis</i> , <i>lutea</i> , L.,                    | 8                              | 8                              | 274           | 34                               | 20                   | 685           | ..                                                             |
| 3.                                                                                      | <i>V. lychnitis</i> , <i>alba</i> , by pollen<br>of <i>V. thapsus</i> , L. var. <i>alba</i> ,<br>of gardens, .. | 10                             | 5                              | 98            | 20                               | 20                   | 392           | ..                                                             |
| 4.                                                                                      | <i>V. lychnitis</i> , <i>alba</i> , by pollen<br>of <i>V. phæniceum</i> , L. var.<br><i>alba</i> of gardens, .  | 5                              | 4                              | 113           | 28                               | 20                   | 565           | ..                                                             |

TABLE 4.—Pure and Mixed Unions of *V. lychnitis*, *lutea*, L. as ♀

| No.                                                                                                            | No. of flowers ferti-<br>lised. | No. of capsules pro-<br>duced. | No. of seeds. | Average of seeds<br>per capsule. | By calcula-<br>tion.  |               | The<br>comparative<br>fertility of<br>the different<br>unions. |       |
|----------------------------------------------------------------------------------------------------------------|---------------------------------|--------------------------------|---------------|----------------------------------|-----------------------|---------------|----------------------------------------------------------------|-------|
|                                                                                                                |                                 |                                |               |                                  | No. of cap-<br>sules. | No. of seeds. |                                                                |       |
| 1. <i>V. lychnitis</i> , <i>lutea</i> , L. by own<br>pollen,                                                   | 6                               | 6                              | 226           | 38                               | 20                    | 753           | 1000                                                           |       |
| 2. <i>V. lychnitis lutea</i> by pollen<br>of <i>V. lychnitis</i> , <i>alba</i> ,                               | 8                               | 7                              | 249           | 36                               | 20                    | 711           | ..                                                             | 944.2 |
| 3. <i>V. lychnitis</i> , <i>lutea</i> by pollen<br>of <i>V. phæniceum</i> , L.,                                | 5                               | 3                              | 75            | 25                               | 20                    | 500           | ..                                                             | 664.0 |
| 4. <i>V. lychnitis</i> , <i>lutea</i> by pollen<br>of <i>V. phæniceum</i> , L. var.<br><i>alba</i> of gardens, | 5                               | 3                              | 63            | 21                               | 20                    | 420           | ..                                                             | 557.7 |
| 5. <i>V. lychnitis</i> , <i>lutea</i> by pollen<br>of <i>V. phæniceum</i> , L. var.<br><i>alba</i> of gardens, | 5                               | 2                              | 37            | 18                               | 20                    | 370           | ..                                                             | 491.3 |
| 6. <i>V. lychnitis</i> , <i>lutea</i> by pollen<br>of <i>V. blattaria</i> , L. var. <i>alba</i><br>of gardens, | 8                               | 4                              | 85            | 21                               | 20                    | 425           | ..                                                             | 564.4 |
| 7. <i>V. lychnitis</i> , <i>lutea</i> by pollen<br>of <i>V. blattaria</i> , <i>lutea</i> , L.,                 | 8                               | 5                              | 97            | 19                               | 20                    | 388           | ..                                                             | 515.2 |
| 8. <i>V. lychnitis</i> , <i>lutea</i> by pollen<br>of <i>V. thapsus</i> , <i>lutea</i> , L.,                   | 10                              | 7                              | 123           | 18                               | 20                    | 351           | ..                                                             | 466.1 |
| 9. <i>V. lychnitis</i> , <i>lutea</i> by pollen<br>of <i>V. thapsus</i> , L. var. <i>alba</i><br>of gardens,   | 10                              | 5                              | 75            | 15                               | 20                    | 300           | ..                                                             | 398.4 |
| 10. <i>V. lychnitis</i> , <i>lutea</i> by pollen<br>of <i>V. nigrum</i> , L.,                                  | 10                              | 6                              | 182           | 30                               | 20                    | 607           | ..                                                             | 806.1 |
| 11. <i>V. lychnitis</i> , <i>lutea</i> by pollen<br>of <i>V. virgatum</i> , With.,                             | 10                              | 5                              | 111           | 22                               | 20                    | 444           | ..                                                             | 589.6 |
| 12. <i>V. lychnitis</i> , <i>lutea</i> by pollen<br>of <i>V. thapsiforme</i> , Schrad.,                        | 8                               | 3                              | 52            | 17                               | 20                    | 347           | ..                                                             | 460.8 |

In Table 3 we have first the results of the pure unions of *V. lychnitis*, *alba*, and by comparing them with those resulting from fertilisation with the pollen of *V. lychnitis*, *lutea*, we find that the latter cross-unions undergo the proportionately decreased fertility of 100 : 82. By the hybrid-unions of *V. lychnitis*, *alba*, with the pollen of *V. phæniceum*, *alba*, a slightly higher degree of sterilisation results; the proportion in this case being as 82 : 67, relatively to 100 produced by the pure unions of *V. lychnitis*, *alba*. The highest degree of sterilisation in this Table results from the union of *V. lychnitis*, *alba*, by pollen of *V. thapsus*, *alba*, the proportion of the pure to the hybrid unions being here as 100 : 47.

The results of my experiments on the yellow variety of *V. lychnitis* are given in Table 4. By a comparative examination of this Table, we have the following general results: first, the fertility of the pure unions of *V. lychnitis*, *lutea* exceeds that resulting from the cross-unions of the latter with pollen of *V. lychnitis*, *alba*, in the proportion of 100 : 94. The degree of sterilisation induced by these unions, though less than that resulting from the converse unions given in Table 3, is nevertheless sufficient to show a sterilising influence in the conjunctions of varieties of a species, characterised only by those, systematically considered, trifling differences in colour—the one being white, the other yellow. Secondly we have the results of unions of similarly and dissimilarly coloured forms of distinct species, with *V. lychnitis*, *lutea*. Thus the pollen of *V. phaniceum*, with purplish coloured flowers, applied to the stigmas of *V. lychnitis*, *lutea*, gives an average fertility, of 66; the pollen of the white variety *V. phaniceum*, *alba*, gives an average of 55; while that of the rose-coloured variety is productive of the highest degree of sterilisation, giving only 49—relatively to 100, the produce of *V. lychnitis*, *lutea* by its own pollen. Mr. Darwin, on the authority of Gartner, states in his "Origin of Species," that similarly coloured varieties of distinct species are more fertile when crossed than are the dissimilarly coloured varieties of the same species. The particular illustration of this point will be found in a subsequent part of this paper; I will here merely state that, in the above unions, the degrees of fertility are by no means regulated by the colour affinities. Thus, we have first yellow and violet, then yellow and white, and lastly yellow and rose yielding a successively decreased fertility; whereas, judging by the colour affinities, the arrangement ought to have been, beginning with the most fertile, yellow first with white, then with rose, and lastly with violet. Secondly, with pollen of the *V. blattaria*, *vars. alba* and *lutea*, we see, that the *V. lychnitis*, *lutea* yields the higher degree of fertility with the former: *V. lychnitis*, *lutea*, yielding with pollen of *V. blattaria*, *alba*, 56, and with that of *V. blattaria*, *lutea*, 51, relatively to 100, the product of fertilisation with its own pollen. Thirdly, in the unions of *V. lychnitis*, *lutea*, by pollen of the yellow and white varieties of *V. thapsus*, we find that unions of the similarly coloured flowers are the more fertile. *V. lychnitis*, *lutea*, yielding with pollen of *V. thapsus*, *lutea*, 46, and with the pollen of *V. thapsus*, *alba*, 39, relatively to 100,





TABLE 6.—Pure and Mixed Unions  
of *V. blattaria*, *lutea*, L. as ♀

| No. |                                                                                                          | No. of flowers ferti-<br>lised. | No. of capsules pro-<br>duced. | No. of seeds. | Average of seeds<br>per capsule. | By calcula-<br>tion. |               | The<br>comparative<br>fertility of<br>the different<br>unions. |
|-----|----------------------------------------------------------------------------------------------------------|---------------------------------|--------------------------------|---------------|----------------------------------|----------------------|---------------|----------------------------------------------------------------|
|     |                                                                                                          |                                 |                                |               |                                  | No. of<br>capsules.  | No. of seeds. |                                                                |
| 1.  | <i>Verbasca blattaria</i> , <i>lutea</i> ,<br>L. by own pollen,                                          | 8                               | 7                              | 354           | 50                               | 20                   | 1011          | 1000                                                           |
| 2.  | <i>V. blattaria</i> , <i>lutea</i> by pollen<br>of <i>V. blattaria</i> , <i>alba</i> of gar-<br>dens,    | 6                               | 3                              | 147           | 49                               | 20                   | 980           | ...                                                            |
| 3.  | <i>V. blattaria</i> , <i>lutea</i> by pollen<br>of <i>V. thapsus</i> , <i>lutea</i> , L.,                | 6                               | 4                              | 103           | 26                               | 20                   | 515           | ...                                                            |
| 4.  | <i>V. blattaria</i> , <i>lutea</i> by pollen<br>of <i>V. thapsus</i> , <i>alba</i> of gar-<br>dens, ..   | 6                               | 2                              | 62            | 31                               | 20                   | 620           | ...                                                            |
| 5.  | <i>V. blattaria</i> , <i>lutea</i> by pollen<br>of <i>V. lychnitis</i> , <i>lutea</i> , L.,              | 8                               | 4                              | 81            | 20                               | 20                   | 405           | ...                                                            |
| 6.  | <i>V. blattaria</i> , <i>lutea</i> by pollen<br>of <i>V. lychnitis</i> , <i>alba</i> of gar-<br>dens, .. | 8                               | 1                              | 20            | 23                               | 20                   | 460           | ...                                                            |

The results of experiments on the *V. blattaria*, varieties *lutea* and *alba*, are given in the above Tables: they comprise 12 unions between the white and yellow varieties of three species. Let us briefly compare the results of their reciprocal unions. First, the fertility of *V. blattaria*, *alba*, when fertilised by its own pollen, undergoes the highly proportionate sterilisation of 98 : 78 when fertilised with the pollen of the yellow variety—*V. blattaria*, *lutea*. In the converse case, the sterilising influence of the cross relatively to the pure unions of these forms is much decreased, the pure union of *V. blattaria*, *lutea*, yielding more seed in the proportions of 90 : 88 than from its cross-union with the white variety—*V. blattaria*, *alba*. Secondly, as to the hybrid unions with the pollens of the yellow and white varieties of *V. thapsus*. In these the pollen of the white variety is the more potent. Thus *V. blattaria*, *alba*, fertilised by pollen of *V. thapsus*, *alba*, affords an average fertility of 43, whereas by that of *V. thapsus*, *lutea*, the produce is reduced to 32, relatively in both cases to 100, the average fertility of *V. blattaria*, *alba*, when fertilised by its own pollen. By the union of the yellow and white varieties of *V. thapsus* with the yellow variety of *V. blattaria*, we see that the relative differences in the

potency of the two pollens on the stigmas of *V. blattaria*, *lutea*, are much less than those we have above noticed when *V. blattaria alba* is used as female; and also that the potency of the two pollens is greater on the stigmas of the yellow than those of the white variety of *V. blattaria lutea*; and again that the white variety of *V. thapsus* is more fertile than the yellow, in their respective unions with the *V. blattaria, alba*. Thus *V. blattaria, lutea*, by pollen of *V. thapsus, alba*, gives an average fertility of 61; by pollen of *V. thapsus, lutea*, 50, relatively to 90, the product of fertilisation by its own pollen. Lastly, we have the different unions of the two pollens of the white and yellow *V. lychnitis* on the stigmas of the yellow and white varieties of *V. blattaria*. In these unions we see first that with *V. blattaria, alba* as female, the pollen of the white variety exceeds that of the yellow in the proportion of 36 : 23; secondly, with the *V. blattaria, lutea*, as female, the pollen of the white variety is again singularly enough the more fertile, exceeding that of the yellow variety, in the proportion of 45 : 41. Thirdly, we find that here also the yellow variety of *V. blattaria* yields a higher degree of fertility,—taking the conjoint products of the two unions with the pollen respectively of *V. thapsus, lutea* and *alba*,—than the white variety of *V. blattaria* when similarly treated, the proportions being as 70 of the *V. blattaria* to 47 of the *V. blattaria, alba*, or nearly as 3 : 2.

This leads me to notice a curious fact prominently brought before us in the above Table, whatever may be its real signification, namely, that the yellow varieties of *V. lychnitis* and *blattaria*, though yielding a higher grade of fertility to the pollen of the white and yellow varieties of distinct species than do the respective white varieties of the above species when similarly fertilised, are nevertheless less productive of seed than the white, when both are fertilised with their own pollen. This will be seen by consulting the following tabular arrangement, in which I have given a reduced approximate of the relative fertility of the different unions, selecting from the hybrid unions in each instance only the most fertile.

1. *V. lychnitis, alba*, by own pollen is as 83 : 75 of *V. lychnitis, lutea*, by its own pollen.

2. *V. lychnitis, alba*, by pollen of *V. lychnitis, lutea*, is as 68 : 71 of *V. lychnitis, lutea*, by pollen of *V. lychnitis, alba*.

3. *V. lychnitis*, *alba*, by pollen *V. thapsus*, *alba*, is as 39 : 30 of *V. lychnitis*, *lutea*, by pollen of *V. thapsus*, *alba*.

4. *V. lychnitis*, *alba*, by pollen of *V. phæniceum*, *alba* as 56 : 42 of *V. lychnitis*, *lutea*, by pollen of *V. phæniceum*, *alba*.

5. *V. blattaria*, *alba*, by its own pollen, is as 98 : 90 of *V. blattaria*, *lutea* by its own pollen.

6. *V. blattaria*, *lutea*, by pollen of *V. blattaria*, *alba* is as 96 : 79 of *V. blattaria*, *alba*, by pollen of *V. blattaria*, *lutea*.

7. *V. blattaria*, *lutea*, by pollen of *V. thapsus*, *alba*, as 61 : 43 of *V. blattaria*, *alba*, by pollen of *V. thapsus*, *alba*.

8. *V. blattaria*, *lutea* by pollen of *V. lychnitis*, *alba*, as 45 : 36 of *V. blattaria*, *alba*, by pollen of *V. lychnitis*, *alba*.

We thus see, from the eight pure, cross, and hybrid unions of *V. blattaria alba* and *lutea* given in the above comparative table, that though the white variety exceeds in fertility the yellow variety, when both are fertilised by their own pollen, the yellow variety, in the mixed unions, is in every case more highly fertile than the white. In the different unions of *V. lychnitis*, *alba* and *lutea*, there is some little discordance, this, however, is confined to the hybrid unions which are as yet very insufficiently illustrated, as may be seen by consulting Tables 3 and 4. In the case of the pure and cross unions, we see, as in those of *V. blattaria*, that in the *pure unions* the *white* variety, and in the *cross unions* the *yellow* variety is the more fertile.

I know not whether this concordance is casual or otherwise, but I was so forcibly struck with it in the comparative study of my Tables, that I have thus ventured a special statement. I have been more especially induced to notice it also from its evidently bearing and illustrating, as I am inclined to think, that view of Mr. Darwin, (*loc. cit.*) respecting the good derived from cross fertilisation; inasmuch as we see that the yellow and original, or normally coloured, form of the species is less fertile than the white or derivative form in the pure unions, whereas in general, in the mixed unions, the yellow variety relatively exceeds the white in the degree of fertility. Any how, the mere fact of such variations occurring, whether or not they have any bearing on other points of theoretical natural science, seems to me worth noticing, as affording an additional link to that broken chain of

evidence which is said to disjoin the serial continuity of the phenomena of mongrelism and hybridism.

| TABLE 7.—Pure and Mixed Unions<br>of <i>Verbascum thapsus</i> , <i>lutea</i> ,<br>L. as ♀. |                                                                                                        | No. of flowers ferti-<br>lised. | No. of capsules pro-<br>duced. | No. of seeds. | Average of seeds<br>per capsule. | By calcu-<br>lation. |               | The<br>comparative<br>fertility of<br>the different<br>unions. |       |
|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|---------------------------------|--------------------------------|---------------|----------------------------------|----------------------|---------------|----------------------------------------------------------------|-------|
|                                                                                            |                                                                                                        |                                 |                                |               |                                  | No of<br>capsules.   | No. of seeds. |                                                                |       |
| No.                                                                                        |                                                                                                        |                                 |                                |               |                                  |                      |               |                                                                |       |
| 1.                                                                                         | <i>Verbascum thapsus</i> , <i>lutea</i> , L.<br>by own pollen,                                         | 8                               | 8                              | 920           | 115                              | 20                   | 2300          | 1000                                                           |       |
| 2.                                                                                         | <i>V. thapsus</i> , <i>lutea</i> by pollen<br>of <i>V. thapsus</i> var. <i>alba</i> of<br>gardens,     | 4                               | 2                              | 218           | 109                              | 20                   | 2180          | ...                                                            | 917.8 |
| 3.                                                                                         | <i>V. thapsus</i> , <i>lutea</i> by pollen<br>of <i>V. lychnitis</i> , <i>lutea</i> , L.,              | 6                               | 1                              | 54            | 54                               | 20                   | 1080          | ...                                                            | 465.2 |
| 4.                                                                                         | <i>V. thapsus</i> , <i>lutea</i> by pollen<br>of <i>V. lychnitis</i> , var. <i>alba</i> of<br>gardens, | 6                               | 3                              | 187           | 62                               | 20                   | 1216          | ...                                                            | 541.7 |
| 5.                                                                                         | <i>V. thapsus</i> , <i>lutea</i> by pollen<br>of <i>V. nigrum</i> , L.,                                | 10                              | 4                              | 275           | 69                               | 20                   | 1375          | ...                                                            | 597.8 |
| 6.                                                                                         | <i>V. thapsus</i> , <i>lutea</i> by pollen<br>of <i>V. pyramidatum</i> , Beib.,                        | 10                              | 6                              | 374           | 62                               | 20                   | 1246          | ...                                                            | 541.7 |
| 7.                                                                                         | <i>V. thapsus</i> , <i>lutea</i> by pollen<br>of <i>V. thapsiforme</i> , Schrad.,                      | 10                              | 8                              | 408           | 51                               | 20                   | 1020          | ...                                                            | 443.2 |
| 8.                                                                                         | <i>V. thapsus</i> , <i>lutea</i> by pollen<br>of <i>V. virgatum</i> , With.,                           | 10                              | 5                              | 222           | 44                               | 20                   | 888           | ...                                                            | 386.0 |
| 9.                                                                                         | <i>V. thapsus</i> , <i>lutea</i> by pollen<br>of <i>V. blattaria</i> , <i>lutea</i> L.,                | 8                               | 3                              | 98            | 33                               | 20                   | 653           | ...                                                            | 283.9 |

In Table 7 we have several unions of the yellow variety of *V. thapsus*. If we compare these results, we see that the fertility of the *V. thapsus*, *lutea*, by its cross-unions with the *V. thapsus*, *alba*, is decreased in the proportions of 94 relatively to 100, the product of fertilisation by its own pollen. We also see a great difference in the degrees of potency of the two pollens of the white and yellow variety of *V. lychnitis* on the stigmas of the yellow variety of *V. thapsus*; the pollen of *V. lychnitis*, *alba*, exceeding in its fertilising influence that of *V. lychnitis*, *lutea*, in the proportion of 54 : 46. Judging from the results of the seven hybrid unions given in this Table, we also see how little the recognised systematic affinities of species guide us in pronouncing *a priori* as to the degree of fertility of their several unions. For example *V. thapsiforme*, *V. virgatum* and *V. blattaria*,

though much more closely allied to the *V. thapsus* than the others given in Table, are nevertheless least effective in their conjunctive fertility with the latter species. Furthermore, we see by those unions of *V. thapsus*, *lutea*, as female, with the yellow and white varieties of *V. lychnitis*, and of *V. pyramidatum*; that though the pollen of *V. pyramidatum* is equally potent on the stigma of *V. thapsus lutea*, as is that of *V. lychnitis, alba*, there is nevertheless a considerable decrease in the proportionate fertility of the unions with *V. lychnitis, lutea*. Hence, as we have before shown it to be with the varieties of *V. phaniceum*, and judging by the physiological test, the *V. pyramidatum* would interpolate itself between these slightly different and undoubted varieties of a species.

In the foregoing Tables, then, I have given nearly all the results of my experiments in the unions of *Verbascum*. Before considering the nature of the evidence they afford us as to the relationship of mongrelism and hybridism, I will briefly attempt to show how far these results accord with those of Gartner, who has also largely experimented on these plants. I may premise, however, that as my experiments are much less numerous than Gartner's, comprising some 57 distinct unions, in which 527 flowers were artificially fertilised,—whereas, as will be seen beneath, Gartner subjected no less than 1085 flowers to experiment,—they would induce very different conclusions, in certain points, to those arrived at by that careful experimentalist. I readily acknowledge therefore the higher claim of the latter to a provisional acceptance, until further experiments show more conclusively their relative correctness. I have also to notice a cause of some little discordance in such a comparative examination as that which I am about to institute; namely, that I have given in every case the *average* number of seeds produced both by *pure* and *mixed unions*, whereas Gartner gives the *average number* of seeds in the *pure unions* only, taking in each case the *maximum* or highest number produced by a single capsule in the *mixed unions*. I was not aware of this peculiarity in Gartner's deductions when I counted the seeds in my own experiments, otherwise, I should have drawn them up for the sake of comparison on a similar basis; even though I consider it a less fair method than that which I have adopted, in all such cases as the present, in which the ovaries

contain an *indefinite* number of ovules. And this the more especially if, as in my own experiments, *castration* and *artificial impregnation* be performed in both *pure* and *mixed* unions. In drawing comparisons between *uncastrated* pure unions, and *castrated* mixed unions, the *average* of the former, with the *maximum* of the latter would certainly be the fairer method, as affording a complement for the sterilising influence of castration.

For the following digest of Gartner's experiments I have to thank Mr. Darwin, who kindly sent it to me from his yet unpublished MS. illustrations of these phenomena: "To show the scale on which Gartner worked, I may state that, in the genus *Verbascum*, he crossed no less than 1085 flowers and counted their seed, and recorded the results. Now in two of his works he distinctly asserts that similarly coloured varieties of *V. lychnitis* and *V. blattaria* are more fertile together than when differently coloured varieties of the same species are crossed. But Gartner chiefly relied on the crosses which he made between the yellow and white varieties of these two species and nine other distinct species, and he asserts that the white-flowering species yielded more seed than did the yellow-flowered varieties when crossed with the same white varieties of these two-flowered species, and so conversely with the yellow flowering varieties with the yellow species. The general results may be seen in his Table. In one case he gives the following details; the white *Verbascum lychnitis* naturally fertilised with its own pollen had on an *average* in 12 capsules 96 good seeds: 20 flowers artificially fertilised with the pollen of its yellow variety gave as the *maximum* 89 good seeds. I should have thought that this slight difference might have been wholly due to the evil effects of castration; but Gartner shows that the white variety of *V. lychnitis*, fertilised by the pollen of the white and yellow varieties of *V. blattaria*, in both of which cases there must have been previous castration, bore seeds to the white variety in the proportion of 62, to 43 when pollen of the yellow variety was used."

First then, in regard to the greater fertility of the unions of similarly coloured varieties, relatively to that of the unions of dissimilarly coloured varieties of the *same* species. To these phenomena I will apply in the subsequent parts of this paper the following terms: "*Homo-chromatic*" to the unions of similarly coloured varieties, and "*hetero-*

chromatic" to those in which dissimilarly coloured varieties are united. In the following table we will at once see the comparative fertility of these different unions given in the previous ones.

RELATIVE FERTILITY OF THE HOMOCROMATIC AND HETEROCHROMATIC  
UNIONS.

|                                                                                                |      |
|------------------------------------------------------------------------------------------------|------|
| 1. <i>V. phæniceum</i> by its own pollen, . . . . .                                            | 1000 |
| 2. <i>V. phæniceum</i> , <i>rosea</i> , by pollen of <i>V. phæniceum</i> , ...                 | 958  |
| 3. <i>V. phæniceum</i> , <i>alba</i> , by pollen of <i>V. phæniceum</i> , <i>rosea</i> , ...   | 867  |
| 4. <i>V. phæniceum</i> , <i>alba</i> , by pollen of <i>V. phæniceum</i> , . ...                | 735  |
| 5. <i>V. phæniceum</i> , by pollen of <i>V. phæniceum</i> , <i>rosea</i> , . ...               | 680  |
| 6. <i>V. phæniceum</i> , by pollen of <i>V. phæniceum</i> , <i>alba</i> , ...                  | 563  |
| 7. <i>V. lychnitis</i> , <i>alba</i> , by pollen of <i>V. lychnitis</i> , <i>lutea</i> , ...   | 822  |
| 8. <i>V. lychnitis</i> , <i>lutea</i> , by pollen of <i>V. lychnitis</i> , <i>alba</i> , . ... | 944  |
| 9. <i>V. blattaria</i> , <i>alba</i> , by pollen of <i>V. blattaria</i> , <i>lutea</i> , ...   | 792  |
| 10. <i>V. blattaria</i> , <i>lutea</i> , by pollen of <i>V. blattaria</i> , <i>alba</i> , ...  | 969  |
| 11. <i>V. thapsus</i> , <i>lutea</i> , by pollen of <i>V. thapsus</i> , <i>alba</i> , . ...    | 947  |

Here the comparative fertility is shown by calculation from the number of seeds produced by 20 assumed capsules of both unions. The various cross-unions of *V. phæniceum* and its varieties are in each case to be considered relatively to the assumed results of the pure unions of *V. phæniceum* given in Table 2, these plants experimented upon being individually self-sterile as shown in Table 1. The unions, on the other hand, of *V. lychnitis*, *blattaria*, and *thapsus*, with their respective varieties, are each to be considered relatively to the 1000 seeds produced by the pure union of that variety given as female. Now in all the above heterochromatic unions, as compared with the homochromatic, we have the clearest evidence of reduced fertility. Thus, taking the 10 heterochromatic unions given, and comparing them with a similar number of homochromatic unions, we find that the average proportion in which the former exceeds the latter, is as .05 to .23. On again confining ourselves to those species alone which have the yellow and white varieties, and keeping the unions of white as ♀ with yellow ♂, distinct from those of yellow as ♀ with white as ♂, we find that the cross-unions with white as female are to the pure unions of the latter as .04 to .28; and in those cross-unions with yellow as female,



the proportions are as .23 to .29, relatively to the pure unions of the latter. Thus, in whatever way we proceed, the general results are the same, testifying to the highly remarkable fact announced by Gärtner, that varieties of a species, characterised by no other differences than that of colour, are occasionally so differentiated functionally, that the cross-unions, as compared with the fertility of the pure unions, invariably indicate a certain degree of sterilisation!

In connection with this higher relative fertility of homochromatic to that of heterochromatic unions, as limited to the crossing of varieties of a single species, I will venture to add that this law not only holds, but, as I believe, extends to and regulates the functional relations in accordance with the relative colour affinities of the varieties crossed. Thus for the sake of illustration, we may take the three primary colours of the cyanic series, namely, blue, violet, and red. Now beginning with red, we know that greater physiological changes must take place in the minute anatomy of the petals of an originally red-coloured flower to give the impression of blue than that of violet. Hence we might suspect that a species presenting varieties characterised by such differences in colour, would likewise afford different degrees of fertility in their conjunctive functional relations, the blue and red yielding less fertile unions, than the violet and red; while the violet holding an intermediate colour position between these, might be equally as fertile in its unions with the blue as the red variety. In practical illustration of these relations, we may take the results of the various unions of *V. phaniceum* and varieties given in Table 1. Thus the *V. phaniceum* with purplish-violet flowers yields more seeds when fertilised by the pollen of the rose-coloured variety, than by that of the white variety, in the proportion of 5 to 4. Again the white variety of *V. phaniceum* fertilised by the pollen of the rose variety yields an average of 29 seeds per capsule, and by that of the purplish violet variety the average per capsule is 26, that is as 9 to 8, in favour of the unions of the rose and white varieties. We see here evident co-relations between the degrees of fertility and the colour affinities of these plants in their respective sexual unions, and I venture to look for more marked differences in these respects, had we as subjects of experiment,

varieties of a species presenting three, or at least two, of the primary colours with intermediate shades irrespective of the white. The latter being rather unsatisfactory from its similar relations to the primary colours, though in such instances as the above of the purplish-violet, rose and white, in which we have secondary colours forming intermediate steps between the primary and white, by a gradual dilution of the colouring principle, we find that the white, agreeably to the above views, form less fertile conjunctions with the violet than the rose-coloured flowers. Before passing from this point of my subject, I will now only add that I have thought these indications of a tangible law, co-relating and regulating the sexual functions of varieties when crossed—dim though they as yet undoubtedly are—worth noticing, as we are as yet in utter ignorance of anything like definite or specific laws in these phenomena, the results being considered as most capricious and uncertain.

Gartner's second proposition is, that in the hybridism of differently coloured varieties of distinct species of *Verbasca*, the conjunctions of the similarly coloured flowers are more fertile than these of dissimilarly coloured flowers. For example Gartner shows\* that on the calculation of *V. lychnitis*, fl. *alba*, yielding with its own pollen 1.000 seeds, it yields when fertilised with the pollen of *V. blattaria* fl. *alba*, 0.622 seeds, and with that of *V. blattaria*, fl. *lutea*, only 0.438, so that the similarly coloured unions of these species are more fertile than the dissimilarly coloured unions in the proportion of 3 to 2. Let us now see then in how far this law of the differences in the fertility of the homochromatic relatively to the heterochromatic unions, is borne out in the case of my own experiments as given in the preceding Tables. And here again, for the sake of clearness, and facility of reference, I will restate them in a tabular form, and show as clearly as possible the differences in the relative fertility of the homochromatic and the heterochromatic unions, in each case, by making calculations from an assumed 100 seeds produced by the more fertile of the two unions compared. The results may be conveniently arranged under three heads; thus, first, the heterochromatic unions, or those in which the unions of differently coloured flowers are the more fertile: second, the homochromatic unions, or those in which similarly colour-

\* Versuche über die Bastarderzeugung, 1849, section 216. \*

ed flowers are the more fertile: and lastly, the irregular unions in which no relations are observed between the degree of fertility and affinity of colours.

A. 1.—HETEROCHROMATIC UNION, *the MORE fertile.*

1. *V. lychnitis, lutea*, by pollen of *V. blattaria, alba*, . 100
2. *V. lychnitis, lutea*, by pollen of *V. blattaria, lutea*, . „ to 91
3. *V. blattaria, lutea*, by pollen of *V. thapsus, alba*, . 100
4. *V. blattaria, lutea*, by pollen of *V. thapsus, lutea*, . „ to 83
5. *V. blattaria, lutea*, by pollen of *V. lychnitis, alba*, . 100
6. *V. blattaria, lutea*, by pollen of *V. lychnitis, lutea*, . „ to 88
7. *V. thapsus, lutea*, by pollen of *V. lychnitis, alba*, . 100
8. *V. thapsus, lutea*, by pollen of *V. lychnitis, lutea*, . „ to 87

B. 2.—HOMOCHROMATIC UNIONS, *the MORE fertile.*

1. *V. lychnitis, lutea*, by pollen of *V. thapsus, lutea*, . 100
2. *V. lychnitis, lutea*, by pollen of *V. thapsus, alba*, . „ to 85
3. *V. blattaria, alba*, by pollen of *V. thapsus, alba*, . 100
4. *V. blattaria, alba*, by pollen of *V. thapsus, lutea*, . „ to 76
5. *V. blattaria, alba*, by pollen of *V. lychnitis, alba*, . 100
6. *V. blattaria, alba*, by pollen of *V. lychnitis, lutea*, . „ to 66

C. 3.—DEGREE OF FERTILITY AND AFFINITY OF COLOUR

IRREGULAR.

1. *V. lychnitis, lutea*, by pollen of *V. phæniceum*, . 100
2. *V. lychnitis, lutea*, by pollen of *V. phæniceum*, . „ to 80
3. *V. lychnitis, lutea*, by pollen of *V. phæniceum*, . „ to 74

In A. and B. of the above comparative tables, I have arranged those unions in which a certain regularity is observed between the colour relationship and the degree of fertility. Now, by comparing the 14 unions therein given, we find that the heterochromatic unions are, in the greater number of cases, more fertile, viz., as 8 to 6, than the homochromatic unions, and that this higher fertility, in every case, results from those unions in which the yellow variety of the species is treated as female. Again that the average proportion of the four heterochromatic to the four converse homochromatic unions in the first of the above tables is nearly as 7 to 6 in favour of the former. In B. 2 of the tabulated results, we see in one

instance the homochromatic unions with yellow as female exceed in fertility the converse heterochromatic union; but in the other cases given in lines 3 and 5, this higher fertility of the homochromatic unions is yielded by the white variety; the relative proportions of these being much more marked than in the above cases of the heterochromatic union with the yellow variety as female, viz., as 4 to 3, whereas, as we have seen, in the heterochromatic, A. 1, the proportions are as 7 to 6. In further illustrations of this point we see in B. 2 that the yellow homochromatic union of *V. lychnitis*, *lutea*, by pollen of *V. thapsus*, *lutea*, relatively to the heterochromatic unions of the former with pollen of *V. thapsus*, *alba*, is nearly as 5 to 4, so that we here again see (as in the heterochromatic and homochromatic unions in A. 1) a more intimate approximation between the products of these two unions, than occurs in the other cognate unions of B. 2, in which the white variety is the more fertile.

These curious relations, however, as I have already shown, are partly explained by the fact,—though we can only dimly see why it should be so,—that in the pure unions of the white and yellow varieties of the above mentioned species, the white, in every case, yields more seed than the yellow; whereas in the cross-unions the yellow variety in general is the more productive. But, it may be asked, how is the greater potency of the pollen of the white variety relatively to that of the yellow variety, as shown in the above tables to be accounted for? Does it really imply that the female element of the yellow variety yet retains its normal or original potency, the male element alone having become absolutely less potent, as compared with the male element of the white variety. This hypothesis, analogically considered, does not seem to me at all improbable. I think we have clearly seen by the comparative results of the pure and mixed unions of the yellow variety with those of the white, that the pure unions of the yellow do not yield a degree of fertility at all proportionate to that of the like unions of the white variety, as judged by the relative fertility of their cross-unions; and that accordingly this would seem to be due to an acquired weakness in the generative powers of the yellow variety. In noticing this point in a former part of my paper, I treated it as if both sexual elements had undergone a similar decrease in their generative powers;

but we here see that it is more particularly, if not altogether confined to the male element. Now, as the results of hybridisation show that the pollen is more susceptible to the concomitant sterilising action of hybridism than the female element, may we not suppose that the debilitating effect of continued self-impregnation will also manifest itself more quickly in the male than in the female element, and thus afford an explanation of the decreased sexual powers of the male, as compared with the female element, in the yellow varieties of the above species of *Verbascum* furthermore, showing us that as it has been a slowly acquired quality, so will it be in its elimination and regainment of its pristine vigour.

The relations of the several reciprocal unions in the above tables is another point which we must briefly consider, as having most important bearings on the subject of our present enquiry. A hasty examination suffices to show that these are much complicated. Thus *V. lychnitis*, *lutea*, in its two unions with the white and yellow varieties of *V. blattaria*, the heterochromatic unions are the more fertile; whereas in its two unions with the white and yellow varieties of *V. thapsus*, we find it yields the more fertile by a homochromatic union. Again *V. blattaria*, *lutea*, in its four distinct unions with the white and yellow varieties of *V. thapsus* and *V. lychnitis*, yields the higher degree of fertility in the heterochromatic unions, while the *V. blattaria* in its similar unions with the white and yellow varieties of *V. thapsus* and *lychnitis* is, singularly enough, more highly fertile in the homochromatic than the heterochromatic unions. Lastly the *V. thapsus*, *lutea*, yields more seed by its heterochromatic unions with pollen of the *V. lychnitis*, *alba*, than by its homochromatic unions with the *V. lychnitis*, *lutea*; whereas in the converse unions we have seen that the *V. lychnitis*, *lutea*, is more fertile in the homochromatic unions with *V. thapsus*, *lutea*, than in the heterochromatic unions with *V. thapsus*, *alba*!

The tabulated experiments given in C. 3, afford another source of complexity to the question under examination, inasmuch as they are quite irregular in the relative degree of fertility produced by the affinity of colour. Thus by the three unions of *V. lychnitis*, *lutea*, with pollen of the three varieties of *V. phœniceum*, the most highly fertile is that in which *V. lychnitis*, *lutea*, is treat-

ed with pollen of the purplish violet, or normal form, the average in this being 25 seeds per capsule; then follows the unions with pollen of the white variety, the average of seeds being in these 21 seeds per capsule; and lastly in the unions with the variety with rose-coloured flowers, the fertility of *V. lychnitis*, *lutea*, is reduced to the low average of 18 seeds per capsule. Thus judging by the degrees of fertility, we clearly see that the natural functional co-relations of these plants in place of being regulated by their respective colour affinities, arrange themselves in an entirely independent and opposite scale; the extremes in the scale of colour given, viz., the purplish-violet with yellow, manifesting the nearest functional co-relation. Again as a further complication we find that the white and yellow unions,—the most closely allied of the colours mentioned,—hold a medial position between the purplish violet and rose. How obviously futile then, we may well remark, would our *à priori* conclusions have been, as to the degrees of fertility of the above unions, on a presumed coordination between colour and function in the phenomena of hybridism!

It would thus appear from the results given in the foregoing tables that in the hybridisation of varieties of distinct species characterised by differences of colour alone, no definite relations whatever can be observed between the affinities of colour, and the degrees of fertility, but that in these cases as in the reciprocal hybridisation of pure species, the relative fecundity is a most variable and unpredictable quantum. This view seems to me to be further supported by the results of my experiments on the reciprocal hybridisation of the dimorphic species of *Primulæ*\* in which I showed that the laws of dimorphism were limited in their action to the unions of the two forms of a species; the heteromorphic and homomorphic unions of distinct species proving irregularly the more fertile. From considering the important functional co-relations of the two forms of dimorphic species, and their trifling morphological characteristics, together with the specifically limited extent of their operations, we have less reason to be surprised, if a similarly limited relationship should ultimately prove to regulate the degree of fertility of those unions of differently coloured varieties of a species as in *Verbasca* and analogous cases. Indeed, judging

\* Linn. Soc. Jour. Vol. 8, p. 78.

from my previous remarks on the co-relations between the degree of fertility and affinity of colour in the crossing of varieties of a species, together with the results of the hybridising differently coloured varieties of distinct species, this law seems clearly indicated, that the relative degree of fertility of the cross unions between the differently coloured varieties of *certain* species is inversely proportionate to the less or more mediate colour affinities of these unions. Further that this law does not extend to, or regulate the hybrid unions of differently coloured varieties of distinct species, but is strictly limited in its operations to those unions of varieties of a single species. Such at least is the conclusion which my own experiments would induce me to hold, but seeing that they are so directly opposed to the results of Gärtner's large experience, I would rather avoid at present anything like definite or positive conclusions, until subsequent experiment affords us a crucial array of data.

In conclusion, I will now by a cursory retrospect of the above details, re-state a few of the more important points, which elucidate the mooted relations between the phenomena of the hybridisation of a species and the mongrelism of the varieties of a species. First then in *hybridism* we see on the calculation of *V. lychnitis* yielding with its own pollen 100 seeds, it yields upon fertilisation with pollen of *V. nigrum* 80 seeds, by the pollen of *V. virgatum* 58 seeds, by that of *V. phæniceum* 66 seeds and by that of *V. thapsiforme* 46 seeds. In the unions of varieties of a species, with these of other species we find differences in the sexual powers, so that the pollen of the one variety of a species is less potent than that of the other on the stigmas of the same variety of another species. Thus *V. lychnitis* fertilised by the pollen of *V. blattaria*, *lutea*, yields 51 seeds, by that of *V. blattaria*, *alba*, 56 seeds, and again by pollen of *V. thapsus*, *lutea*, *V. lychnitis* yields 46 seeds, by that of *V. thapsus*, *alba*, 39 seeds, relatively in each case to the 100 seeds produced by its own pollen. Again we have evidence also of reciprocal differentiation in the relative sexual powers of varieties of a species, and those of other species. Thus in the case mentioned above of *V. blattaria*, the pollen of variety *alba* is more potent on the stigma of *V. lychnitis* than that of variety *lutea*, whereas in the converse unions of these forms, we find that the pollen of *V.*

*lychnitis* is more potent on the stigmas of *V. blattaria*, *lutea*, than that on those of the variety *alba*, in the proportion of 40 to 26.

Secondly, in mongrelism, we also find variabilities in the relative sexual powers of varieties of a species, by differences in the degrees of fertility resulting from their simple and reciprocal unions. Thus on the calculation of *V. phæniceum*, yielding 100 seeds by fertilisation by its own pollen, it yields with that of the variety *rosea* 68 seeds, and by that of the variety *alba*, 56 seeds, or nearly as 5 to 3. In the reciprocal unions of these varieties, we also find variabilities in their converse sexual powers. For example, in the reciprocal unions of *V. phæniceum* and varieties, the potency of the pollen of *rosea* relatively to that of *alba* on the stigmas of the normal form is nearly as 5 to 4; whereas the pollen of the latter on the stigmas of *rosea* and *alba* is as 4 to 3. This difference in the reciprocal sexual powers of varieties when crossed is so regulated however by colour affinities, that unlike the irregular and indefinite results of the reciprocal unions of varieties of distinct species, judging by my own experience, we see that the pollen of *rosea* is more potent on the stigmas of the normal form than these of *alba* and so conversely, the pollen of the normal form is more potent on the stigmas of *rosea* than on those of *alba*. In those cases, however, in which colour differences do not come into play the pollen of one variety, relatively to that of another variety of the same species is so differentiated with respect to their reciprocal stigmatic relations that the grade of fertility of the pure unions of these varieties does not at all correspond with that of the cross unions. For example, in the pure unions of varieties *lutea* and *alba* of *V. blattaria*, the fertility of the latter exceeds that of the former in about the proportions of 12 to 11; whereas in their converse unions, *lutea* exceeds *alba* in the higher proportions of 6 to 5! Thus in the inter-crossing of varieties of a species, as in the inter-crossing of varieties of distinct species, there are converse variabilities in the reciprocal sexual powers of their respective elements.

As the facts stand then, it appears to me that in the first crosses of the varieties of certain species, as in the first hybrid crosses of distinct species, a variable degree of sterilisation results, and again, that the relative sterilising influence is as highly intensified in the crossing of undoubted varieties of certain species, as it is in the hybridising of



several undoubtedly distinct species. There is also a parallelism between the results of reciprocal hybridisation of varieties of distinct species, on the one hand with those of the reciprocal inter-crossing of varieties of a single species on the other. The sole difference in the two lines at least is merely as to the degree of extension ; species relative to species occupying a higher point in the divergently extended line, than do the varieties of a species relatively to each other, and accordingly yielding in general more intensified results, harmoniously testifying to the truth of Mr. Darwin's remark that sterility is simply a superinduced quality due to incidental differences in the reproductive system....As in the varieties of a species, however, we find that the relative amount of physiological divergence,—as judged by the fertility of their reciprocal conjunctions,—is by no means regularly or definitely co-ordinated with their morphological ; so in the hybridisation of the different species of a genus, the most distinct morphologically are often found to be most nearly allied in their physiological characteristics, and thus there being no necessary co-ordination of these characteristics we can readily understand how the sterility of the first crosses of varieties of a species may, and occasionally does, exceed that of well-marked and undoubtedly distinct species.

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*Contributions towards a history of PANOLIA ELDI; McLelland.*

By Captain R. C. Beavan, C. M. Z. S. &c.

The published accounts of this comparatively rare species of deer are scattered through back numbers of various scientific periodicals and proceedings of Societies, some of which are out of print, and not easily procured. I have therefore brought together nearly all that has been previously written on the subject, and added much information on the manners and habits of the species procured during a recent visit to its haunts in Burmah.

*PANOLIA ELDI*. The Sungnái.

Nondescript Deer, McLelland, Calcutta Journ. N. H. Vol. I. p. 501, Pl. XII.

*Cervus Eldi*, Guthrie, (Calcutta Journ. N. H. Vol. II. p. 405, Pl. XII.

*C. lyratus*, Schinz. Syn. Mam. II 395.

*C. dimorphe*, Hodgson, Journ. As. Soc. Bengal, Vol. XII. p. 897.

*C. smithi*, Gray, Proc. Zool. Soc. 1837, p. 45.

*Panolia acuticornis*, Gray, List Mamm. B. M. 180.

*Panolia platycercos*, Gray. List Mamm. B. M. 181, adult; Cat. Osteol. B. M. 66.

*Cervus (Rusa) frontalis*, McLelland, Calcutta Journ. N. H. III. p. 401, Pl. XIII. Sundevall, Pecora, 132.

*Panolia Eldi*, (The Sungnái), Gray. Cat. Hodgson Coll. B. M. 34; Osteol. B. M. 66: Knowsley Menag. Cat. Mam. in Museum As. Soc. Bengal, Blyth, 1863, p. 149.

*Native names*, Sungnái, apud Guthrie and Blyth: Sungraëë apud Eld: Thámyn of Burmah.

*Hab.* Pegu, northward to the valley of Munipore: Siam: and proximate portion of the Malayan Peninsula, (Kedda) Mergui, (Blyth.)

The first notice we have of this deer, was published in 1841,\* and entitled—'Indication of a nondescript species of Deer by John McLelland.'

"Captain Guthrie of the Bengal Engineers, employed in the construction of a road from the valley of Cachar to Monypore, procured the horns of a deer whose lower, or basal antler descends in the axis of the

\* Calcutta Journ. Nat. Hist. Vol. I. p. 501, Pl. XII.

beam, rather as an extension of the horn itself than as a mere shoot. The horn may be compared to the segment of a circle, the burr, or root from which both limbs extend, being placed on the outer circumference. The beam is round, and terminates by a fork, as in the *Rusa* deer. The lower prolongation of the horn beneath the burr may also be said to terminate in a fork, for on the left horn, about two inches below the root, there is a small snag directed forward. In illustration of this notice, a figure of the horns is given at pl. 12."

Captain Eld, one of the principal assistants to the Commissioner of Assam, who had been previously attached to the British Residency in Muneypore, having had his attention called to the notice and the figure alluded to, soon after wrote an interesting letter on the subject, which affords the first general information hitherto received relative to the habits and character of this interesting species. His description is as follows:.\* "I observe mention made of a new description of Deer, said to exist between Munipore and Cachar; some specimens of the horns of which were procured in the latter place by Captain Guthrie. From the drawing, it is evident to me that the Deer alluded to is of the kind originally discovered by myself in the valley of Munipore in the beginning of 1838, and several pairs of the antlers of which were given by me to Captain Guthrie in the same year. I had intended at the time to send a description of the animal to one of the Journals, but was told that a similar Deer was to be found in the north-western jungles. As this, however, does not appear to be the case, I now forward you a correct drawing of a pair of the horns in my possession, together with a short account of the animal &c. taken from notes made at the time in my sporting diary; and which you are welcome to make use of in any way you please.

"The *Sungraëë*, as it is called by the natives, or large Deer of Munipore, is only to be found in the valley of that state, but neither in Cachar, nor the Kubo valley, nor in any of the Naga hills surrounding Munipore. Its favourite haunts are the low grass and swamps round the edge of the Logta, (lake) at the western end of the valley, and the marshy ground at the foot of the hills. It is gregarious in its habits, and after the annual grass burning, I have frequently seen herds of two and three hundred. The colour of the males from the month of November, till about the end of May, is of a dark brown,

\* Calcutta Journal Natural History, Vol. II. p. 415.

nearly approaching to black, and their bodies are covered down to the knee-joints with thick shaggy coats, resembling split whalebone, of four to eight inches in length.

"The hair about the neck is very thick, and just like a horse's mane, and the appearance the stag presents when roused, with his shaggy mane standing on end, coupled with the strong smell which at this season proceeds from their bodies, perceptible at 40 and 50 yards distance, is so formidable, that I have known the boldest elephant refuse to approach them. In June the stags commence shedding their horns, and the new ones have nearly attained their full size by the end of November, but are in perfection in February and March; about this time also (June) they change their coats, which lose their whalebone texture, and become of a beautiful glossy chesnut colour, and about half an inch in length. The contour of their peculiarly small heads, and the perfect symmetry of their forms, divested of their long bristly coats, are now fully developed, and at this season they are, in my opinion, the most beautiful and graceful of the Deer species. The height of the full grown stags averages about eleven and a half hands, and that of the does three or four inches less. The colour of the latter is always the same—a bright bay, but more glossy during the rains than at any other time. The principal distinction between the *Sungrae* and others of the Deer species consists in the peculiar shape of the lower antlers, which, instead of breaking off at an angle where they are set on the head, preserve the continuity of curve downwards, and project over the eyes of the animal, which they nearly hide, their semicircular shape giving the Deer, when at gaze or in motion, the appearance of having too distinct pairs, the one inclining forwards and the other backwards. The generality of the stags have from six to ten branches or snags, but I have killed very old ones, with no less than sixteen clearly defined branches.

"It would be a great object gained, could any live specimens be procured for transmission to Europe, but it would I fear be attended with much difficulty. I have known several instances of the fawns being caught and thriving well for months, but at about a year old, they invariably pined away and died; nor have I known or heard of a single instance of one having arrived at maturity, this too in their native climate; and I therefore think the chances of one surviving a

voyage home but small. I have written to a friend in the valley to send me a complete skeleton of one with the skin &c., and he has kindly promised to do so if he can succeed in procuring one; but says he can hold me out but slender hopes, as the Deer now seem to bear a charmed life, and roam about unpersecuted by anybody."

The next detailed description of this deer was given by Dr. McLelland in 1842,\* and I quote his remarks nearly in full.

"Although differing considerably in the form of the horns from any of the *Rusa* deer, still the general form, the colour, the mane, and the Asiatic habitation of the species, seem to refer it to the *Rusa* group, of which it forms one of the most unique and striking examples.

"The form of the skull agrees more with that of *Cervus hippelaphus* than with that of any other species that I can refer it to, but the nasal and intermaxillary bones, as well as the muzzle generally, seem to be somewhat more prolonged and compressed, and though the face is broad and flat between the eyes, the forehead is compressed, and the head as well as the muzzle narrow, and the profile nearly straight, but with a short prominent ridge commencing on the forehead, and extending between the horns. There are two canine teeth, not much developed, in the upper jaw of both sexes, and the suborbital sinuses are large.

"The horns are large and directed backwards, and obliquely outwards without ascending from the burr: they are then curved gradually upwards and outwards, and terminate in a point directed forward. A single small antler extends obliquely inward from the upper third of the horn; this antler in young individuals appears to form a fork with the summit, but in the adult it is placed about six or seven inches from the top point of the horn, and is more or less developed according to age; in the adult, and particularly in aged individuals, an imperfect nodular spine extends from the base of this antler towards the point of the horn, with several irregular blunt snags arising from it, forming an incomplete kind of crown. The brow antler advances directly forward from the burr, and bending upwards and onwards, terminates in a point which, if prolonged, would meet the summit of the horn, and thus complete an almost perfect circle.

\* Calcutta Journ. Nat. Hist., Vol. III. p. 401, Pl. XIII. XIV.

" A single little snag sometimes shoots out promiscuously from the base of one or other horn, more frequently from that of the brow antler.

" The length of the horn following the curve is three feet, and that of the brow antler twenty inches. The circumference of the ~~horn~~ is five and a half inches, that of the brow antler five inches, and both together form one extended and uniform curve of four feet and seven inches; the horns spreading laterally from each other to a distance of three feet, and then approaching at their bases to an inch or an inch and a half.

" *The body* in its general symmetry is light, the limbs slender but strong, the ~~horns~~ long, black, and pointed; the head is carried erect; the tail short and conspicuous in the summer dress, but only appearing as a short tuft in the thick winter coat.

" *The coat* is thick and dense in winter, longer and coarser on the neck than on other parts, forming a thick but undefined mane of straight, harsh, and coarse hair, five or six inches long in the winter, but in summer the mane is more defined. From the withers the hair becomes shorter, diminishing towards the tail, which in summer is thinly clad, though in winter it is covered with a dense clothing of hair, in common with all the upper parts of the body. On the face, the muzzle, the limbs, and the external ears, the hair is short, close, and compact; on the lower surface of the chest it is coarse and short; it is thin, lengthy, and fine on the under-parts of the belly. The inner parts of the thighs and upper and inner parts of the forelegs are also thinly clad.

" *The colour* changes from yellowish brown in summer to a brownish grey in winter: during summer, brownish grey prevails on the face and neck, becoming yellowish brown on the upper parts of the body, the backs of the ears, and the upper and outer part of the limbs and the muzzle. The belly, the inner parts of the thighs and the forelegs, the under parts of the lower jaw, the hips, the tail, and adjoining parts of the rump are white in summer, but the rump and upper parts of the tail partake of the colours of the upper parts of the body in winter. The lower parts of the limbs are light grey, the same also prevails irregularly round the eyes, and corners of the mouth and nose, and lengthy tufts of light grey hair cover the inner surface of the ears."

Mr. Blyth, as noticed above, considers the *Cervus dimorphe* of Hodgson to be identical with the species under notice; but that the horns of the individuals figured by the latter are abnormal, on account of their being developed in captivity. Had not Mr. Hodgson mentioned, (as quoted hereafter,) that his animal was three years old and the horns perfect, I should have been inclined to have considered it as bearing its first year's horns.

The following information was obtained during a recent visit to Burmah.

Lieut.-Colonel Blake kindly furnished me with the following account: "As regards the exact localities of the *Thamyn* I can only say where I have found them and where not. As far as I know they do not occur to the south of Moulmein, but from within a short distance of Thabyoo point, the south-western headland of the Martaban district, to Sittang, bounded to the eastward by the forest line, they are found in large herds.

"Again, on the opposite side of the Sittang river, to the south and west of Pegu, they are also found in large numbers. How far they extend in a westerly and northerly direction, from the mouth of the Rangoon river, and in the Bassein district, I do not know, but I have heard that they are common even as high up as Munipore.

"From Pegu to the north they are found in very small parties, the ground not suiting them, until you cross the "Koon" creek or river, the separating boundary between the Martaban and Thoungoo districts, and from this to within a few miles of Thoungoo they occur in large herds.

"Sometimes the plains or open spaces between the Eng\* forests will be covered with them, and three or four hundred may be seen at one time. Under these circumstances they are shy and very difficult of approach. Strange to say, that although the ground appears quite as favourable for them, I have never seen a single one to the eastward of the Sittang river north of Sittang. From the above, you will see that they are gregarious in their habits. During the night, and early morning and evening, they frequent the plains, and where the forest jungle is not distant, they retire into it during the heat of the day.

\* *Dipterocarpus grandifolia*, Wallich; Wood oil Tree, Mason's Burmah, edit. 1860, p. 493.

"Their food, I imagine, consists of grass. I cannot call to mind having seen more than *one* fawn with its mother.

"The colour of the young, as well as that of the females, is what is termed light fawn colour (light rufous?) The males are sometimes of the same, and sometimes as dark as the male of the Sambur, *Rusa hippelaphus*. I know not if any change takes place in their coats with the change of seasons."

Colonel D. Brown, Officiating Commissioner at Moulmein, has noticed them to range along both banks of the Irrawaddy, on the proper right bank up to Meanoung, and on the left bank as far as Meaday, on the British frontier, N. Lat 19° 40' E. Long. 95° 20' (approximately). He has also observed them as plentiful at Theegwen, near Bassein, a few at Pudoung opposite Prome, and to be more sparsely scattered through the Therrawaddy district.

For most of the following information I am indebted to the courtesy of J. Davis, Esq, Superintendent of Police in the Martaban District, an Officer well known for his intimate acquaintance with the Burmese language; hence his services as interpreter were invaluable when Burmese and Karen Shikarees had to be questioned.

Pioneered by him, early in October last, I visited the haunts of the *Thamyn* near Thatore (a town about 40 miles N. W. of Moulmein), and although, owing to the dense nature of the vegetation covering the plains at that time of year, I was only able to see a few scattered females and young of the second year, yet the insight thus afforded into their habits and economy more than repaid me for the severe attack of illness I subsequently incurred by exposure to the heat and wet.

This plain of Yengyaing was then, owing to the recent and heavy falls of rain, one large swamp. Nearly the whole of its unbroken extent, which embraces an area of 14 miles in length with an average breadth of 10, could be traversed in a small canoe, except here and there, where mud and vegetation combined obliged one to resort to a very unpleasant system of half wading in water, and half sticking in deep slime. A continuation of this plain, broken up by belts of jungle, extends for several hundreds of miles up the Burmese coast, and has evidently been formed by the gradual retirement of the sea, which at one time doubtless dashed its waves against the Martaban and other continuous ranges of laterite hills. It is now, at Yengyaing,



some eight to ten miles distant from the hills, and seems to be still retiring, since the water along the coast of this gulf of Martaban is very shallow and studded with sandbanks. For the primary cause of this we may doubtless look to the immense amount of silt deposit brought down by the waters of the Salween, Beeling, Sittang and Rangoon rivers, all of which discharge themselves into the gulf of Martaban. As the sea retires, a belt of mangrove jungle about a mile in width appears to travel with it, thus enclosing the plain with a barrier of vegetation on one side and the mountains on the other. This strip of mangrove jungle gives cover to numberless hog-deer, tiger, leopard and pig, but is never entered by the *Thamyn*, except where somewhat open; nor on the other side do they ever attempt to penetrate into the mountains. The plain is intersected by numerous tidal creeks which in the hot weather, when deprived of water from the hills, appear to dry up to a great extent, and those still open at that time of year contain no admixture of fresh water, so that it is evident, that for two, if not three, months in the year, the *Thamyn* must be entirely deprived of fresh water, whilst during the rainy season, for six months at least, they may be said to live in water. It appears wonderful how they can manage to exist in such extremes of heat and wet. With the exception of a few stunted trees, and a fringe of hibiscus bushes along the creeks, the plain is covered with nothing but grasses and paddy, of which latter both the wild and cultivated varieties are abundant: owing, however, to the paucity of the population and the consequent demand for labour in this immediate neighbourhood, perhaps only one fourth of the whole area is under cultivation for paddy: this crop succeeds here admirably, and the grain forms one of the staple articles of export from Moulmein and other Burmese ports. The remaining three fourths are covered with the indigenous uncultivated plants which, in seasons of scarcity, are reaped and used for food. This tract of country forms a vast grazing ground both for the *Thamyn*, and for large herds of tame buffaloes which are during the rains pastured here by the Karens, but withdrawn into the heavy jungles near the hills, when, in April and May, the whole of the vegetation on the plain becomes parched up, or is devoured by jungle fires. At the time of my visit vast flocks of waders and other water-birds were arriving from the

north, and the creeks were filled with pelicans of several species; whilst the mud flats absolutely swarmed with stints, sandpipers, egrets, and especially the rosy *tantalus*. Here and there, stalking gravely amongst the flowering paddy, might be seen pairs of the Sarus crane, (*Grus antigone*), or a troop of adjutants, both of which breed in the neighbourhood. Occasionally the rarer Javanese adjutant was met with, and the Jabiru stork, *Mycteria australis*.

The rutting season commences in the middle of March and lasts throughout April, to the middle of May.

The female gestates nearly seven months, and brings forth her young in October and November, amongst the jungle paddy which is then flowering or in seed, and at its greatest height. The sexes begin to breed at about 18 months old and the female has only a single young one at a time, which frequently stays with its mother until the second year.\* Females have only four teats. In colour they are much like the female Sambar, but perhaps a little lighter. The young are at first spotted or mottled, but this disappears with age. The females are hornless. In the second year the young males first begin to acquire horns which are perfectly developed in March, and shed in the middle of the rainy season, that is about September.† After two years they get two tines, and when about seven years old are in their prime with twelve tines (including the brow antler). The natives have a vague idea that two distinct species, the lesser and the greater *Thamyn*, are to be found in the same herds, distinguishable only by difference of size in horns, and colour; but this of course is to be accounted for by the individual distinctions common to all races of animals.

The average weight of the male is from fifty to sixty vis,‡ that of a female forty vis.

Four men can carry a male with ease, when disembowelled and quartered.§

\* The mother will breed a second time in 18 months after bringing forth, so that the young of two seasons are not unfrequently seen with their parents.

† As noticed above by Blyth in Major Tickell's specimen at Moulmein.

The colour of a full grown buck is dark brown, especially about the back and neck, with underparts lighter. As far as I can ascertain there is no trace of a mane, and the texture of the coat varies considerably with the seasons; more exact information on these points is however needed.

‡ A vis is equal to 140 tolaks.

§ As noticed by Blyth, the Burmese always quarter deer with the skin on. The Karens, however, will not eat the meat, because they think it will breed cholera.

The male averages  $3\frac{3}{4}$  feet in height at the shoulder. The female is a little less : the very largest males do not exceed  $4\frac{1}{2}$  feet. The flesh is much liked by the Burmese, and always finds a ready sale in the neighbouring villages. It is rarely brought into Moulmein. In the country the wholesale price of a doe is Rupees 3, and that of a buck Rs. 4,\* which is of course less than the usual retail bazar rate.

The flesh is said to smell a little about the end of March when the weather is very hot, but about November and December it is in good condition for the table.

Their habitat and range, according to Mr. Davis, are as follows : In the Martaban District they inhabit exclusively the open-grassy plains between the sea and the mountains. In the Pegu plains they are perhaps more abundant than in any other part of Burmah ; next to them the Yengyaing plain in Martaban produces most ; near Rangoon they are found in the Dallah plain. About Pegu and Yengyaing they are found in herds from fifty to an hundred in the month of March, but when hunted, they congregate much more, and as many as two hundred may then be seen together. In habits they are essentially gregarious, and associate with no other species, although hog deer abound in the grass and jungle along the edges of the plain ; nor will they allow the tame buffaloes to come nearer to them than about 100 yards. In habits they are very wary and difficult of approach, especially the males ; they are also very timid, and easily startled. The males, however, when wounded and brought to bay with dogs, get very savage, and charge vigorously. On being disturbed, they invariably make for the open, instead of resorting to the heavy jungles like hog deer and Sambur. In fact, the *Thamyn* is essentially a plain loving species, and although it will frequent tolerably open tree jungle, for the sake of its shade, will never venture into any composed of dense or matted underwood i. e., bush jungle in contradistinction to " tree jungle." Indeed I was credibly informed of a large stag which, being driven into a corner of the plain last year, by herd boys, with pariah dogs, and finding no means of escape, took refuge in heavy jungle where its horns got entangled in a hibiscus bush, and so was actually captured alive. Its captors, however, soon put an end to its existence with a sharp dhar.

\* The prices quoted are what a shikarry expects usually to realize.

When first startled, their pace is great. They commence by giving three or four large bounds like the *axis* or spotted deer, and afterwards settle down into a long trot, which they will keep up for six or seven miles on end where frequently disturbed. This is when the vegetation on the plain is comparatively short. In the rains they do not go far before they find a hiding place in the long paddy. Their powers of leaping are highly developed. On the Yongyaing plain alone there are at the present time about a thousand head, on the Thatong plain, a little further to the north west, perhaps a hundred head only, which go about in small herds of seven and eight. At Yengyaing the annual number killed amounts to about forty-five, including those bagged by Europeans, and about five natives gain their livelihood in that place, almost entirely by the sale of the flesh. They are least gregarious in the rainy weather, the females have mostly then retired in twos and threes into quiet spots, and the herds are altogether more scattered, owing to the increased density of the vegetation. They feed during both day and night, chiefly however in the early morning and evening, their food consisting principally of the jungle paddy. During the night they do a great deal of damage to the cultivated variety, treading down more than they eat. They also feed on grass, and on the leaves of two jungle trees called in Burmese the "Keay" and the "Thamey," the scientific appellations of which I am unable to resolve.\* In a tamed state they will eat plantain leaves.

The call of the female, uttered when disturbed, is a short barking grunt, that of the males is louder and more prolonged. It is most frequently heard in the rutting season, during which period the males have frequent and severe battles; a pair have been known to have been captured whilst so engaged, with their antlers interlocked.

\* I lately had a stag *Panolia* in confinement for many months. It was put out every day among capital pasture, but invariably abstained from eating it. I tried it with a number of trees and found that it eat quickly the leaves of *Ficus venosa*, *religiosa* and *indica*, and that the tender shoots and leaves of bamboos were its special favourite. It was kept close to a tank in which *convolvulus reptans* was growing luxuriantly, and it was accustomed daily betimes to stand in the water up to its middle, and feed on the leaves of this plant also. It did not appear, however, to be so fond of the water as the nearly affined *barasingha*, *Rucervus Duvaucellii*. A male of the latter species in my possession, in the hot season, used to spend the greater part of the day lying in the water. Its food also apparently differs from that of the *thamym*, for it browsed on common pasture, and while in the water fed on the long straggling grass *Seersia hexandra* (Editor.)

About the end of January the first jungle fire sweeps over the plain and destroys the dry herbage, leaving small patches here and there about the edges of swamps. The second burning takes place about the end of March, and leaves scarcely a blade of grass behind it; the plain is then almost entirely bare, and the deer having no cover congregate in large herds. They are then to be seen on all sides, and, the buffaloes having previously withdrawn to the tree jungle, are left alone in their glory, and, as noticed before by Colonel Blake, become at this time excessively wary. From the middle of February until the first showers fall at the end of April they apparently subsist without water, they lie in salt swamps during this period, and get the benefit of the heavy dews at night. Their only enemy appears to be man, but an epidemic occasionally breaks out amongst them and destroys large numbers. The last occurred in 1863, and some fifty or sixty head fell victims. The cause of this murrain is unknown, it is probably analagous to that which yearly in Burmah, during the rains, creates such havoc amongst domestic cattle. The Burmese readily eat the diseased flesh, and experience no bad effects from doing so. The disease attacks old and young alike, apparently causing great emaciation and loss of strength, and the animal at last dies of pure weakness. It will probably be found to be some swelling or affection of the throat and lungs, which prevents the animal from eating.

There seems to be no doubt that, in Burmah, this species is gradually decreasing, and will, at no distant date, be excessively rare. This can be accounted for by the gradual but steady increase of the population, and the greater area of country (which must naturally increase yearly) which is taken up for the cultivation of rice. Unfortunately for the *thamyn*, the whole of their favourite locale is excessively well adapted to the cultivation of rice, and there is no doubt that where the indigenous wild plant is found, there also the cultivated variety will flourish. The rice trade of Burmah is yearly increasing in extent; and a few years bid fair to see the present haunts of the *thamyn* not unlike the present state of the greater portion of the rice producing plains of lower Bengal. An intelligent Burmese shikarree, who has been a hunter from his youth upwards and is now an elderly man, tells me that in former years, before Martaban was taken by the British, the *thamyn* were much more abundant than they are now, and that

the natives used to destroy them wholesale at battues: a large number of men would assemble from the surrounding villages and gradually encircle three or four moderately sized herds with long strings, upon which plantain leaves were tied so as to flutter in the wind. The circle originally formed at some distance was gradually lessened, as the deer, afraid to pass the scarecrows, got gradually driven together, until they were completely surrounded and at the mercy of the hunters. The object was to get them into a corner near the heavy jungle, into which if they attempted to run, they either became entangled or allowed their pursuers to get up quite close. My informant tells me that, in former years, he has himself seen as many as 150 to 200 killed in one battue. To such a length was this system carried, and such enormous havoc thereby created, that the Burmese Government, fearing that the species would be utterly exterminated, wisely put a stop to the practice. This shikariee informed me that five-and-twenty years ago he has seen as many as five hundred head in one herd, and his account was confirmed by others. At the present day, vast mounds of their bones, in every stage of decay, exist on the Thatong plain, the site of many a battue in former times. The value of a whole carcass then was only 4 annas or  $\frac{1}{2}$  tical weight of Burmese silver, equivalent to eight or ten annas of our coinage at the present day! Several intelligent men are now living in the vicinity of Thatong and Yengyaing who formerly took part in these wholesale slaughterings, and, like many others of the present generation, are apt to look back fondly to those good old times.

These battues or *kyowine* were preceded by all sorts of ceremonies and sacrificial rites, offerings being previously made to the tutelary nâts or deities of the woods and plains, to ensure success. In addition to these battues, and the recent increase of cultivation and population, we may account for their gradual decrease by the great increase that has taken place, of late years, in the number and use of fire-arms. Nearly every Burman can shoot, and a large proportion have each their matchlock or cheap Birmingham gun. It is excessively difficult to catch a *thamyn*, even a young one, alive, owing to the open nature of the country which they frequent; and several officers in the Burmese Commission have for some time past been endeavouring, without success, to procure young individuals of both sexes

for the Zoological Society of London.\* Major Tickell had one alive for some time in Moulmein, but it was eventually killed by pariah dogs which got into its enclosures at night. My informant, the shikarree, tells me that he had one also some years since; he caught it when about three months old, fed it on milk at first, and afterwards on grass and plantain leaves, and, after a short time, it became so tame that it would follow its owner about, and never attempt to leave the dwellings of man; after an interval of two years, it got a small pair of horns shaped like those of the adult, but much smaller. Finally, like most pets, it met with an untimely end, being stolen and killed for food by rapacious Burmese officials. From this the species appear to be capable of easy domestication, although it is said by some invariably to pine away and die after capture. The horns of the species are of large size, and are kept by the natives for making handles for sickles. The small ones are of no value, and are either thrown away or cut up and used as pegs.

As to medicinal qualities, when a buffalo is bitten by a snake, the horn of the *thamyn* ground to powder is mixed with a solution of the leaves of the "Yekazoon" (*Ipomœa. sp.* or *convolvulus*.) and given internally, as it is said to cure the bitten animal immediately. No other part of the beast appears to be used medicinally, and the above mentioned nostrum is of no avail for the human race.

In conclusion, there is one point to which I wish to draw especial attention, as one on which our information at present is very limited. It is not known for certain whether the *thamyn*, in its first year, has horns without the brow antler, or whether they are the same as those of adult individuals, but smaller and with fewer tynes. The *pros* and *cons* on either side of the question are I find about equal. It remains for those who have the opportunity of rearing the young animal in captivity, or of shooting a young one, to prove which is the right view of the case.

\* I have since heard that Col. Phayre has one at the present time alive at Rangoon, and Mr. Grote one at Alipore, supposed to be the young of this species.

A fine full grown stag which I received for Col. Phayre is now in the Zoological Soc. Gardens, London.—*Editor*.

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*Zoological Notes.*

By William T. Blanford, F. G. S.

Cor. Mem. Z. S. Lon.

[Received 10th June, 1867.]

The following notes refer chiefly to the distribution of various animals in India and Burma, and to the habits of a few species. There is much in them which is probably not new, more especially with regard to the habits of animals. Still the subject is so interesting, and so little studied by naturalists for want of opportunity, that I trust these few remarks may have some interest. All the facts noted are from personal observation, except where the contrary is stated.

1. *The Lion in India.* Mr. Blyth, about 2 years since, called attention to the circumstance that lions had been recently met with in parts of India in which the animal had been supposed to be extinct. Since that time, one or two other localities have been added to the list of those in which lions have been met with. A paragraph went the round of the newspapers rather more than a year ago, in 1866, to the effect that a lion had been killed near Rewah. An account of the death of this animal was given in the new Oriental Sporting Magazine; and again in "Land and Water," for December 8th, 1866, Captain Le Meunier described the locality and gave the dimensions of the skin. The animal was killed by Messrs. Lovell and Kelsey, of the Jubbulpoor railway staff: it was a fine male *with a full mane*. The dimensions of the stretched skin were the following:

|                                            | ft. | in. |
|--------------------------------------------|-----|-----|
| From tip of nose to end of tail, . . . . . | 9   | 8   |
| Ditto to insertion of tail, ... ..         | 6   | 10  |
| Ditto to hinder end of mane, ... ..        | 3   | 6   |
| Across skin from fore toe to fore toe, ... | 6   | 11  |

So that the animal, when alive, probably measured rather less than 9 feet from the tip of the nose to the end of the tail, measured as tigers usually are, that is, by carrying a tape from the nose over the head and along the middle of the back.

The mane is specially mentioned as very full, the longest hairs being about eleven inches in length, the colour yellow sandy, except on the crown of the head, along the crest, and across the shoulders, where a blackish shade prevailed, the hairs being white, black and



yellow, in about equal proportions. The ears were black on the outside, and the tip of the tail was also black; the lower tip white. From the dark colour of a portion of the hair, there can be little doubt that this was not an aged animal, although, from the fully developed mane, it must have been mature, and not a young lion. The spot where it was killed was near the 80th milestone, on the railway from Allahabad to Jubbulpoor.

I am indebted to Mr. Grote for a note from Captain Le Mesurier confirming the above particulars, and adding the following, also mentioned in the letter published in "Land and Water."

"Some few years ago Mr. Court, who is now Commissioner of Allahabad, and a very good sportsman, disturbed two lions on the rocky plain near Sheorajpúr, twenty-five miles west of Allahabad, when he was stalking antelope."

"Two years ago (1864) Mr. Arratoon of the Police shot at and wounded a lion very near Sheorajpúr, and eventually, with native help, stoned him to death, as he had no spare ammunition. Some of the members of my staff saw the skin, and got the story, nearly as I relate it, from Mr. Arratoon, who still holds a police appointment somewhere in the N. W. Provinces."

The last authenticated appearances of an animal now verging on extinction in Central India are, I think, sufficiently worth preserving to demand a record. The Sheorajpúr lion is, I believe, the furthest to the eastward yet known as having been killed in the present century.

Col. Torrens also has written to Mr. Grote to say that lions still occur about Lalatpúr, between Jhansi and Saugor.

A few lions appear to be killed every year about Gwalior and Goona, but the animal is scarce, and, being eagerly sought after by some of the keenest sportsmen in India, it is rapidly becoming scarcer. In the hot weather of 1866 no less than 9 lions were shot by one party in the neighbourhood of Kota in Rajpootana. My information is derived directly from one of the sportsmen, Major Baigire. Of one of these Rajpootana lions I have seen a coloured drawing, taken immediately after death by an excellent artist. The mane was very fine and well developed, although the beast was killed in the hot weather, when the mane, like the rest of the fur, is doubtless thinner than in the winter.

From a native I learn that in a recent beat in Rajpootana (somewhere on the neighbourhood of Kota), no less than 10 lions were turned out. If this story be true, and I think I have heard of similar large gatherings amongst African lions, this animal occasionally collects in much larger numbers than tigers do. At the same time I do not place much faith in the story. The largest number of tigers of which I ever heard as being found together was six. These were full grown animals. Five I have several times heard of. In such cases all are one family, the old tiger and tigress and their full grown progeny. A tigress not unfrequently has 3 or 4 cubs (I have known the latter number of foeti to be taken from the body of a slain animal) but they rarely, I suspect, all attain to maturity.

The lion seems still to exist in 3 isolated parts of Central and Western India, omitting its occasional occurrence in Bundelkund. These are (1) from near Gwalior to Kotah. (2) Around Deesa and mount Aboo, and thence southwards nearly to Ahmedabad and (3) in part of Kattiawar, in the jungles known as the Gheer. It is possible that isolated examples may yet remain in others of its original haunts.

I may add that the opinion expressed by Mr. Blyth (Cat. Mam. in Mus. As. Soc.) of the inferiority in size of the lion to the tiger is quite borne out by all I have heard on the subject. Major Baigire, one of the best known tiger hunters of Western India, who has also killed more than one lion, told me that the muscular development of the latter animal, as displayed in the skinned carcase, is decidedly less than that of the former.

2. The hunting leopard, *Felis (cynalurus) jubatus*. Blyth, in his catalogue, gives the range of this animal in India as confined to the west and south. It is found throughout the greater portion if not the whole of the Central Provinces, though everywhere scarce, and I have seen the skin of a specimen killed near Deogurh in the Sonthal pergunnahs, and brought to that station by a shikaree. I think it will be found to exist, here and there, almost throughout the Peninsula. In Cutch it is said to be the only large feline existing, but I cannot speak positively on this subject.

3. The wild dog. *Cuon rutilans*, Pallas.

The ordinary prey of these animals, who, as is well known, hunt in packs, is the sambar (*Rusa Aristotelis*, Cuv.), the chital or spotted

deer (*axis maculatus* Gray), and the wild pig. But they attack higher game. I have heard a perfectly authenticated account of their destroying a young gaur (*Bos gaurus*), and I myself found the fresh carcass of a full grown (tame) buffalo which had been killed by them. This was in the jungles east of Baroda. Now a buffalo is not an easy beast to kill; very few tigers will attack an adult. It struck me that the teeth of a wild dog would scarcely suffice to tear the enormously thick skin of the throat of their prey: and on examining the carcass I found scarcely the mark of a tooth on the neck and throat, although there were many about the muzzle. The animal had evidently been killed by tearing out its intestines, a portion of the pack meantime holding the animal by hanging on, in bull dog style, to his muzzle and forequarters. I suspect that they kill all large animals in the same way; a young sambur, which I saw on the Nilgiris, had apparently been killed in this manner. I have heard from natives, too, that this is their mode of attacking tigers. That they do attack and kill tigers is so universally stated in India, in every place where the wild dog is found, from the Himalayas to the extreme south, that I do not think its truth can be doubted, startling as the assertion appears. Yet, singularly enough, they never attack men: at least I never heard of their doing so. The wolf, which, although larger, is proportionately their inferior in strength and speed, and which rarely, and in India, I think, never, collects into packs as large as those of *Cuon rutilans*, not unfrequently attacks men, though I believe he rarely attacks an animal of the size of a full grown sambur.

#### RUMINANTIA.

4. The gaur and gayal. *Bos gaurus*, Smith, and *Bos pontalis*, Lambert. I had the unusual advantage last year, and at an interval of 2 months, of seeing five adult examples of both these magnificent bovine species alive. The gaur were wild in the jungles of Nimar, the gayals were the magnificent tame specimens procured by Dr. J. Anderson for the Zoological Society, and living for some time in the Botanical gardens at Calcutta. There could be little question of the purity of breed of the latter; although far more tame and gentle than most domestic cattle, their symmetry and the regularity of their colouring were those of wild animals.

There is, at the first sight, a remarkable resemblance between these two races. The massive proportions, thick horns, short legs, immense

depth of body, the dorsal ridge terminating abruptly about half way down the back, the general colouring, are all characters common to both. But one or two differences are immediately perceived, and others become conspicuous on closer examination. The most remarkable of course are the comparatively straight and wide-spreading horns and the enormously developed dewlap of the gayal, as contrasted with the sharply curved horns and absence of any dewlap in the gaur, and the shorter tail of the former. But if Dr. Anderson's specimens are fair examples of the gayal, they shew that there are several minor distinctions between the two. In the gayals the head is shorter and, I think, altogether smaller than in the gaur, and the dorsal ridge is not quite so high. In the adult bull gayal in Calcutta, the skin of the back and sides is almost naked, as in the buffaloes of the plains of India; this I have never seen in the gaur. The legs below the knees too, which in the gaur are dirty white, are, in these gayals, dirty yellow. The female gayal is darker in colour than the cow gaurs which I have seen, but as the latter vary considerably in tint, the former may possibly do the same.

I have seen a good deal of the gaur in the Satpoora hills during the last few years. It there inhabits the peculiar thin jungles which cover the trap rocks of Central and Western India. These jungles, as is well known, consist of tolerably open spaces of thick grass 3 to 5 feet in height, with small scattered trees. This grass is burnt at the end of the cold weather over the greater portion of the country. In ravines and along the banks of streams the jungle is thicker, but elsewhere there are few places where the trees are an impediment to riding. The gaur feeds in these plains in the morning and evening, drinking in the evening, or at night, and retreating during the day either to a shady ravine, or, during the hot weather, at least, to the top of a high hill, the most breezy spot being apparently chosen, irrespective of shade. So far as I have observed, the gaur, like the sámbar, never remains in the vicinity of water, or drinks, during the heat of the day.\*

The ferocity of the gaur has been, I think, greatly overstated. I have never heard of but one well authenticated instance of an unwounded animal attacking man, though the bulls, like those of all

\* The spotted deer, on the other hand, almost invariably does so. The sámbars, I believe, only drink at night.

large bovines, are undoubtedly dangerous in the rutting season. In general, the gaur is a timid and rather stupid animal, not very sharp of sight, though, like all ruminants and, indeed, all wild mammals, gifted with strong powers of scent.

I have never seen a herd of more than 16, and ten to twelve is a more common number, the herd comprising one or two adult bulls only, the remainder being cows and calves. The bulls remain apart; either solitary, or in parties of two or three. But I have heard both from Europeans and natives of much larger gatherings having been seen. These are doubtless formed by the union of many herds, and this habit of collecting, at particular seasons, in very large numbers, appears common to most ruminants which habitually live in herds. Thus I have seen, in April, at least 150 spotted deer (*Axis maculatus*) together, and I have heard of far larger numbers collecting in the hot season, and I have recently heard of similar assemblages of the bárasingha (*Rucervus Duvaucellii*).

The cows of the gaur, as I have already mentioned, vary considerably in colour, being usually some shade of brown, approaching dun. Some, in Nimar and the Satpoora hills at all events, are of a very red tinge, in some cases approaching closely to the deep red so common in European cattle,—the colour also, I believe, of the cow Banting, *Bos sondaicus*. I am inclined to think that the colour is redder in the cold season than in the hot weather. The usual tinge in the hot season at least is a much duller brown, nearly the colour of the Nilgiri buffaloes. From what I have heard, the tint of these Nimar animals may be lighter than that of the cows in the Western Ghats and southern India, a circumstance probably connected with the much greater exposure to the sun which they must undergo in the thin trap jungles, and also partly, perhaps, accounted for by that tendency which appears to exist in most wild animals to approximate, in their colour, the general hue of their habitat. This is, of course, much lighter in a tract mainly covered by grass, which is dried and of the colour of straw for 7 months of the year, than in the depth of the evergreen forests of Malabar and the Western Ghats.

The size of the gaur, great as it is, is often, I suspect, exaggerated by unfair measurement. Instead of measuring the true height, as is done with horses, the length from the forefoot to the end of the spinal

ridge is substituted. A great addition to the height is also easily made by pulling out the foreleg as the animal lies, and by measuring from the toe instead of from the heel, especially if the cord be curved a little over the side. Another plan I have lately heard of is to stretch a tape from one forefoot to the other over the back, and to take half the resulting length as the height. When it is remembered that the measurements are made by sportsmen, not by naturalists, it will easily be understood that all should be taken *cum grano* and that many may be rejected altogether. My own impression is that it is as rare to find a gaur exceeding about  $17\frac{1}{2}$  hands (5 ft. 10 in.) as it is to meet with a tiger above 10 feet in length. Larger animals do undoubtedly exist, but they are rare, and it is, I think, doubtful if 20 hands (6 ft. 8 in.) is ever reached. To judge from all the horns I have seen, the gaur of no part of India proper attains a larger size than in the Satpoora hills.

The gaur is called *ran pado* in Goozerat and *ran hila* by the Bheels of Kandesh, both words, like the name commonly used throughout Central and Southern India, *ran* or *jungli byns*, meaning wild buffalo, which is just as absurd, as the term *bison* applied by Anglo-Indians. I have even heard the name *arna*, which of course means the wild buffalo, applied to the gaur; and the correct name is rarely used, in Central India at least, except in the neighbourhood of districts where wild buffaloes occur.

5. The wild buffalo, *Bos (Bubalus) buffelus*.

I think Blyth is in error in restricting the range of the aboriginally wild buffalo to the Ganges valley and Assam. (Cat. Mam. As. Soc. p. 163). Wild buffaloes are completely unknown throughout Western and Southern India, but they are common on the east coast, to some distance south of Cuttack at least, and throughout the jungles of Mandla, Raipur and Sumbalpur, extending west as far as the Wein a Gunga and Pranhita, and south to the Godavery; a few herds may occur beyond these limits, but they are very rare. My information is derived partly from my own observation, partly from various sportsmen who have seen and killed the animal in these districts; and I have myself seen the spoils. All that I have seen belong to the *B. speiroceros* race of Hodgson, with horns curving from the base. My reasons for thinking all these animals aboriginally wild, and not feral, are—1st, the perfect symmetry and immense size of their horns. 2nd, the

fact that the tract inhabited by them is contiguous to the area, Lower Bengal and Assam, inhabited by the undoubtedly wild race. 3rd, the circumstance that precisely the area mentioned comprises the range of other animals also restricted, in India proper, to Bengal and the neighbourhood; e. g. *Rucervus duvaucellii* and *Gallus ferrugineus*, concerning the distribution of which I shall have something further to say presently.

6. The four-horned antelope (*Tetracerus quadricornis*.)

This species is especially abundant in the trapeean districts of Western India, it is one of the commonest wild animals in Nimar, Malwa, Khandeish, the western part of the Nerbudda valley, and throughout the Taptee valley. It is also common along the Western Ghats and in the Konkan about Bombay. It lives in jungle, and is generally to be found near water. It is comparatively a solitary animal, and I have never seen more than four together, the two parents and their young. For a long time I was inclined to look upon the animals with only the posterior pair of horns developed as a distinct race, with lighter coloured fur, and I am by no means satisfied that there is not a distinction to be drawn. The two horned specimens, in the country I have mentioned above, are quite as numerous as the four horned, and although they are fully adult, I have failed to find a trace of the cores belonging to the anterior pair of horns on the skull; a specimen with all four horns fully developed and pointed is rare, generally the anterior horns are mere knobs.

Mr. Blyth is, I think, in error in his catalogue of the Mammalia in Mus. As. Soc. p. 166, in applying the name Chikara to this animal. The Chikara or Chinkara (the latter being the correct name, but the *n* is nasal and very little sounded) is the name which I have heard universally applied to the Indian gazelle, *Antelope bennettii*, Sykes. The 4-horned antelope is called *Chousingha* in Hindee, as stated by Mr. Blyth; it is known by the Mahrattas as "*Benkara*" and by the Bheels of Guzerat as *Bokra* or *Phokra*.

7. The Indian antelope and gazelle. (*Antelope bezoartica*, Aldr and *A. Bennettii*, Sykes). Both of these animals can exist without water. The antelope abounds on the strip of sand separating the Chilka lake, which is quite salt, from the sea; and on this strip the only fresh water is obtained from one or two deep wells. The strip is about 30 miles long. I have been assured by so many people that

antelopes do drink in places, that I cannot absolutely assert that they do not, although I suspect their visits to the edges of streams and tanks are rather for the purpose of feeding on the green grass growing there than for drinking. As regards the Chinkara or Indian gazelle, I quite believe that it never drinks. I have seen it in the deserts of Sindh\* in places where the only water for 20 miles around was procured from wells; and in places in Western and Central India where, in the hot weather, the only water is obtained from small pools remaining in the beds of streams, and around which the tracks of almost every animal in the forest may be seen, I never yet saw the very peculiarly formed tracks of the gazelle, although it frequently abounded in the neighbourhood. The four horned antelope, on the other hand, drinks habitually. I have seen it doing so, and its tracks are constantly to be found at water holes. The Nylgai drinks, but not, I think, habitually, except in the hot weather.

8. The Bára Singha, *Rucervus Duvaucellii*. For some remarks on the geographical distribution of this species see further on, under the jungle fowl. The localities given by Mr. Blyth† are Upper Bengal; valley of Nepal; Assam; *Nerbudda* territory; Eastern Sunderbuns. This list requires slight modification. The animal occurs, though scarce, in Beerbhoom, and I believe, here and there throughout the Chota-Nagpoor country, Sirgooja and Chutteesgurb, and it abounds in Bustar, as I have lately learned from Captain Glasfurd, the Deputy Commissioner of Sironcha. It is to be found about Umarkantak, the source of the Nerbudda, and in Mundla, but with one exception, to be presently noticed, not further to the west, and it is unknown throughout the greater portion of the Nerbudda valley. Generally the limits of its range are very nearly those which I have indicated for the wild buffalo.

#### PACHYDERMATA.

9. The Indian wild pigs. *Sus scropha*?

Mr. Blyth has pointed out (J. A. S. B. XXIX, 105) distinctions in the form of the skulls of wild pigs in India, but he has not referred to

\* The Sindh species may be distinct.

† Catalogue of the Mammalia in the Museum of the Asiatic Society. The localities given by Mr. Blyth are in general thoroughly trustworthy, so far as my experience goes. I am therefore the more anxious to correct them where any improvement is possible, a task only practicable to those who like myself have had opportunities for extensive travelling in India.



differences in colour. Now I have seen whole herds (or sounders) of wild pigs which were brown in colour, irrespective of size or sex, and other herds in the same region, all the members of which were black. Large hogs are usually black, becoming grizzled with age, but I have seen a large solitary hog of the brown species, which had been just killed by a friend, and it was the same colour as the smaller animals. The brown race, so far as my observations extend, is never found except in bush or forest jungle, the black pigs are the common wild hog of the plains, but are also frequently met with in forest. These may be accidental varieties, but it is equally probable that the difference in colour is connected with other distinctions. I can, however, only point out the question as one for enquiry.

#### RODENTIA.

10. The Burmese bamboo rat, *Rhizomys castaneus*, Blyth.—In the Catalogue of mammalia in Mus. As. Soc. the locality of a specimen received from me is erroneously entered as South Arakan. The specimen was killed by me at Prome in Pegu. The distinction is important, as the fauna of S. Arakan, and of Arakan generally, is very different from that of Upper Pegu, though many species, like the present, are common to both.

#### CETACEA.

11. The freshwater dolphins of India and Burma (*Platanista*). It is well known that species of *Platanista*—whether the same or distinct, is less clearly ascertained, occur in the Ganges and Brahmaputra and in the Indus. It is less generally known that a species abounds in the Irrawadi. I have seen them in various parts of that river from near the mouth to nearly 100 miles above Ava, and I was told by natives that they are to be met with as far to the north as Bamo, the Burmese frontier. I was, however, never able to obtain a specimen. The species is very likely to differ from that of the Ganges.

I cannot say if these animals are found in any other Burmese rivers. They may very likely exist in the great rivers of Siam and Cambodia, and they should be looked for in the great Chinese rivers. I am pretty certain that in India they are only found in the Ganges, Brahmaputra, and Indus, and their tributaries. I can speak pretty certainly of their non-existence in the Brahmini, Mahanadi (of Cuttack), Godavery, Taptee and Nerbudda, and I never heard of their occurrence in the Krishna or Cauvery.

## AVES.

12. Geographical distribution of the red and Sonnerat jungle fowls. *Gallus ferrugineus*, Gm., and *G. sonneratii*, Tem.

I regret very much having been the means of misleading Dr. Jerdon as to the distribution of the red jungle fowl. I had been told by two different observers that they had seen and shot jungle fowl exactly like the common barn door fowl in and near the Rajpihla hills, and a third had assured me that he had seen specimens of two different kinds of jungle fowl from the same neighbourhood.

I have now been through the Rajpihla hills and the western Satpooras pretty thoroughly, and I am convinced that the only jungle fowl inhabiting those ranges is *Gallus sonneratii*. This species is also found north of the Nerbudda, in the jungles east of Baroda, and around Chota Oodipoor, but how far it extends to the north and north-west I cannot say. It is not improbably to be found in the Aruvelli range and perhaps about Mount Aboo. It occurs throughout the Satpoora hills, north of Kandesh, and indeed throughout the Taptee valley. Further south I have recently shot it in the jungles just east of Chanda.

Jerdon mentions its occurrence at Pachmurri, where, however, I learn from Lieut. J. Forsyth that *G. ferrugineus* also occurs. I am indebted to Lieut. Forsyth for the following most singular fact with reference to the limits of the latter species. He tells me that it is precisely conterminous in the hills south of the Nerbudda with the Bára Singha, *Rucervus Duvaucellii*, and the Sál tree, *Shorea robusta*. The western limits of the great belt of Sál forest which covers so large a portion of Eastern India is in the Mundla district, and there bára singha and red jungle fowl also occur. The sál is not found in Western India; but there is one spot in the Deinwa valley, just under Pachmurri, where a patch of sal forest occurs, and there, and there only, the red jungle fowl and the bára singha are met with, although the nearest spot to the eastward where the three again recur is 150 miles off. Lieut. Forsyth adds that the two kinds of jungle fowl meet on the plateau at Pachmurri and he has shot both there. When in charge of the forests, he has traversed the whole of the jungle tracts south of the Nerbudda, and can speak positively as to the above very curious circumstance. It would be very interesting to ascertain

whether any other animals or plants have a similar distribution. The only hypothesis which appears to account for the existence of an isolated colony of eastern forms like this is to suppose that, like a geological outlier they were formerly connected with the present main range, and that they existed throughout the intervening area in which they are now no larger found.

To the south, the range of the bára singha and red jungle fowl appears again to coincide with that of the sál tree. I have mentioned above the occurrence of the bára singha in Bustar, where Jerdon found both kinds of jungle fowl together, and where the sál tree is also met with. *Gallus ferrugineus* does appear to reach the Godavery further east, as I heard one crowing not long since in the gorge through which the river runs about 50 miles above Rajahmundry.

13. Distribution of the black and painted partridges, *Francolinus vulgaris*, Stephens, and *F. pictus* Jerd. and Selby.

Jerdon, Birds of India, pp. 559, 562, leaves the relative distribution of these two species to the west somewhat undefined. I have only seen or heard of *F. vulgaris* in Sind. *F. pictus* abounds throughout eastern Guzerat near Baroda and Surat, and I believe, extends throughout Kattiawar. It also occurs, though less commonly, in Cutch, where I have seen it.

#### REPTILIA.

The garial (*Gavialis gangeticus*.)

This crocodile is generally supposed be confined to the Ganges and Brahmapútra with their tributaries. It is found also in one other river running into the Bay of Bengal, the Mahanadi of Cuttack. It does not, however, appear to range further south and is unknown in the Godavery. It is wanting in the Nerbudda and other rivers which fall into the sea on the west coast.\* It is also unknown in Burma.

\* I have been recently informed on good authority that it exists in the Indus. EDITOR.

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*Kashmir, the Western Himalaya and the Afghan Mountains, a  
Geological paper, by*

**Albert M. Verchère, Esq. M. D.**

Bengal Medical Service, with a note on the fossils by

**M. Edouard de Verneuil,**

Membre de l'Académie des Sciences, Paris.

(Continued from page 115, of No. II. 1867.)

In April 1864, I sent a box of fossils, mostly from Kashmir, to Professor Faire, of Geneva. M. Faire kindly forwarded these to M. E. J. de Verneuil, who was good enough to examine them carefully, and to write a most interesting note, of which a translation is now given.

Some of the fossils represented in the Plates were not sent to Professor Faire, and some which were sent, are not figured here; the numbers at the head of some of the paragraphs of M. de Verneuil's note refer to the fossils represented in the Plates.

*Note on the fossils forwarded by Mr. VERCHÈRE, by M. EDOUARD DE VERNUEIL, Member of the Académie des Sciences, &c. &c.*

The largest of the two specimens sent, of which the matrix is a dark brown limestone, belongs to the *Productus Semireticulatus*, (Martin), one of the most characteristic species of the carboniferous limestone, in Europe, in Russia and in America. This species has been brought from the south of the Oural, and Mr. Tchihatcheff has found it in Siberia in the Altai mountains.

A specimen of *Productus costatus* (Sowerby). This is a species scarcer than the preceding. The specimen from India shows well the characters of the species such as they are figured by Sowerby, whilst those from Missouri, figured by M. de Konnick, do not possess the large and thick ribs which characterise the original species. The *Productus costatus*, first found in England, does not exist in Continental Europe, except in Russia where I found it in the government of Toula. Some Russian authors mention it from the government of Tiver and of Kalonga.

*Productus Humboldti* (D'Orbigny). This species is very like *P. Granulosus* (Phillips) and *P. Heberti* (Verneuil, Bull. Soc. Geolog. de

France, Vol. XII. p. 1180). It is distinguished from this by its well marked sinus, and its fine and numerous spines strewed without order on the surface and not forming concentric series. The *P. Humboldti* is mentioned by Keyserling as having been found by him in the carboniferous limestone of the Soiwa, an affluent of the river Petchora on the western slope of the north of the Oural. Mr. Davidson has thought proper to make a new species which he calls *P. Purdoni* (on some Carboniferous Brachiopoda collected in India by A. Fleming and W. Purdon in 1848 and 1852, Quarterly Journal of the Geol. Soc. of London, Pl. 2 fig. 5, 1862) based on specimens similar to those under examination, and which came from Chederoo and Moosakhel (Salt Range, A. M. V.). He gives a drawing, under the name of *P. Humboldti*, of a species on which the spines are fewer and confusedly arranged in quincunces, and of which the sinus is very slight and only visible near the front of the shell. I would regard this rather as the *P. pustulosus*.

*Productus Cora*, (D'Orbigny). Two good specimens possessing well the characters of the species.—Discovered first in the Bolivian plateau by D'Orbigny. This species is one of the most characteristic of the carboniferous limestone in England, in Belgium, in Spain and in Russia.

At the time I found it in the last named country D'Orbigny had but just described it; I did not know his work, and, as this shell varies much, I had made two species of it under the names of *P. Tenuistriatus* and *P. Nefledivi*. It is found on both slopes of the Oural, and also in the white carboniferous limestone of the plains of Russia at Sterbitamak on the river Oka, and in the carboniferous region of Douety. Finally it is also mentioned in North America. It has therefore a great geological range.

Four specimens of *Productus*. That in the black limestone and brought from Kashmir is the *P. Flemingii* or *Longispinus* or *Lobatus* (three names of the same animal). It is one of these *Producti* largely distributed on the globe. It has been found on the Mississippi in the state of Ohio and in Kentucky. It exists in England, in Spain, and in Belgium. Messrs. Keyserling and Murchison and I have found it in the governments of Tiver, Kalonga, on the Douetz as well as on the river Belaja near the glacial sea. The specimens from the white limestone of the Kafir-Kote are a distinct

variety, remarkable for a pretty considerable number of tubular spines, and by the large size of its longitudinal striæ, which are often well marked.

Four specimens of a small species which differs from the *P. Longispinus* or *lobatus* by the want of lobes and of a sinus on the middle of the greater valve. It is perhaps the *P. Aculeatus*, (Martin), but the specimens are not good enough to be determined rigorously.

Very small specimens of *Productus* which are perhaps the young of the *P. longispinus* or of *P. Bolivienensis*, (D'Orbigny), of which Keyserling found a valve in the carboniferous limestone of the basin of the Petchora (government of Archangel). It is characterised by well detached ears.

Two specimens of *Athyris*, without the test and too imperfect to allow of their being determined (*Terebratula Subtilita*, Halls?)

Four specimens of a species of *Athyris* which is perhaps new. It belongs to the class of *Terebratulæ* with concentric striæ and internal spires, called by D'Orbigny *Spirigera* and by McCoy *Athyris* (a name, let us remark, which means the reverse of what exists, since, instead of being imperforate, these species have a round hole on the beak). This species from Kashmir approaches the *A. Ambigua*, (Sowerby), and the *A. Globulosa*, (Phoill.), but it is more transverse and the beak is more detached and sharper. It may be called *A. Buddhista*, as proposed by Mr. Verchere. The *A. Ambigua* is found in Russia in the carboniferous limestone, but is rare there, whilst it is common in England.

Two specimens, of which one is perhaps a variety of the *T. Subtilita*, (Hall\*) or the *T. Subtilita* itself. The other appears to me to be an *Athyris Roysii*, (Vernueil), discovered by myself in the carboniferous limestone of Belgium. When this species is well preserved, the shell is seen to be covered by a pilose investment or coating, consisting of very fine spines continuing the lines of growth. The specimen I possess presents traces of this structure in the shape of a pubescence of very fine hairs.

Three specimens in a bad state of preservation, which are probably merely varieties of the *A. Roysii*.

\* The *Terebratula Subtilita* is a species of Hall, found in the carboniferous of the Great Salt Lake in America. Mr. Davidson mentions it from India.

One more specimen of the same species.

Two specimens of a *Terebratulula* which is probably new, but the specimens are not good enough to be determined.

Six specimens of a *Spirifer* which appears to me to be new. 'At first sight one would take it for the *S. Trigonalis*, (Martin), but it differs from it by the narrowness of the sinus, and by the want of folds in that part which most commonly shows some of them, more or less well marked, in the *Sp. Trigonalis*. The narrowness of the sinus reminds one of the *S. Mosquensis*, of Russia.

*Spiriferina* nearly allied to the *S. Octoplicata*, (Sow.), and still more to the *Sp. Cristata* of the Zechstein, two species which Mr. Davidson unites into one. This author figures the *S. Octoplicata* among the fossils of India. The specimen, which is marked No. 16, has narrower ribs and broader furrows than the specimens figured by Davidson. On another are admirably well seen the granulations peculiar to the genus *Spiriferina* of the lias, and to the Permian and Carboniferous species under notice. Pl. I. fig. 2, a, b, c, d.

Great *Cardinia*, perhaps new. Pl. VI. fig. 2.

Two specimens of *Cardinia* bearing a distant likeness to the *C. Ovalis* (Martin,) *C. Uniformis* of the Carboniferous of England and also to the *C. Listeri Unio* (Sowerby,) of the Lias.

M. de Koninck has figured a shell very similar to this under the name of *Solenopsis imbricata*, (Descrip. of new fossils from India, discovered by A. Fleming, by de Koninck, Quart. Journal of the Geol. Soc. vol. 19 Pl. IV fig. 3.) obtained from the carboniferous limestone of Varcho, (Vurcha, Salt Range, Punjab. A. M. V.)

*Aviculo-Pecten dissimilis* (*Pecten id.*, Fleming), This specimen reminds one of the *Pectea Ellipticus*, (Phillips), which is found in the Carboniferous of Russia.

*Axinus*, *sp. nova*. This shells resembles much the *Axinus obscurus*, (Sow. *Schizodus*, King,) of the magnesian limestone or Permian of England. It has also some distant likeness to the *A. Carbonarius* (*vernus*) Sow. Geol. Transac. vol. V. pl. 38.

*Fenestella Sykesi*, Koninck, Quart. Journ. vol. 19, pl. I. fig.,

*Fenestella megastoma*, Koninck, Quart. Journ. vol. 19, pl. I.

*Fenestella*. Undetermined. Pl. V. fig. 1.

A very pretty species which I do not know. Perhaps the *Vincu-*

*laria multangularis* (Postlock). It is to be regretted that the surface is not seen and that the branches are split in two.

*Lithostrotion floriforme*, Flem. a common enough species in Russia in the carboniferous; found also in England.

*Michelinia* or *Beaumontia*. Ill preserved specimen.

*Phyllopora cribellum*, Konnick, Quart. Journ. vol. 19. pl. I fig. 2.

List of species which have been identified from the specimens sent by Mr. Verchere.

1. *Productus Semireticulatus*, Martin.

2. " *Costatus*, Sow.

3. " *Humboldtii*, D'Orbig.

4. " *Cora*, D'Orbig.

5. " *Flemingii*, Sow. = *P. Longispinus* and *P. Lobatus*, Verneuil.

6. " *Aculeatus*, Sow.

7. " *Boliviensis*, D'Orbign.

8. *Athyris ambigua*? Sow. (perhaps *Sp. hova*).

9. " *Royssii*, Verneuil.

10. " *Terebratula Subtilita*, Hall.

11. *Spirifer Vercheri*, Verneuil (new species, nearly allied to the *S. Trigonalis*, Martin, but distinct).

12. *Spiriferina Octoplicata*, Sow.

13. *Cardinia ovalis*? Martin.

14. *Solenopsis imbricata*, Konn.

15. *Aviculo-pecten dissimilis*, Flem.

16. *Axinus*, *Sp. nova* (nearly allied to *A. Obscurus* of the Gechstein)

17. *Fenestella Sykesii*, Konn.

18. " *Megastoma*, Konn.

19. *Vincularia multangularis*? Postlock.

20. *Lithostrotion floriforme*, Flem.

21. *Phyllopora cribellum*, Konn.

#### *Remarks.*

Several notes on fossils collected in India have been published lately; the fossils were forwarded by Messrs. Fleming and W. Purdon and more recently by Captain Godwin-Austen. These publications are 1st, Davidson's Memoir "On some Carboniferous Brachiopoda collected in



India by A. Fleming and W. Purdon, Quart. Journal, vol. XVIII. p. 25 ; 2 plates. 2nd, Description of some fossils from India discovered by J. Fleming, by Dr. L. de Koninck, Quart. Journ. vol. XIX. with 8 plates on which are figured among others some very curious goniatites. 3rd, Geological notes on part of the N. W. Himalayas, by Capt. Godwin-Austen, with notes of fossils by T. Davidson, R. Etheridge and P. Woodward. It is only an abstract of the memoir, without plates. Capt. Godwin-Austen followed the Carboniferous limestone along the foot of the mountains at the north of the valley of Kashmir as far as Ishmalabad.\* The carboniferous series is, according to Capt. G. Austen, as follows, from the highest to the lowest. 1st Layers with goniatites more or less analogous to the ceratites of the Muschelkalk. These layers are the highest of the carboniferous formation. 2nd. Below is found a compact limestone poor in fossils ; 3rd, argillaceous series ; 4th, limestone rich in fossils, *Productus*, &c. 5th quartzite.

As early as 1850, Sir Roderick Murchison had shown me some of the fossils sent by Mr. Fleming, and I had identified the *P. Cora*, *costatus*, Flemingi, the *Athyris Roysii*,\* *Orthis crenistria*, &c. Quart. Journ. vol. 7, p. 39. At the same epoch Dr. Falconer and Major Vicary had announced the existence of palæozoic fossils in the mountains which separate British India from Kabul, as remarked by Sir R. Murchison, Quart. Journ. vol. VII. p. 38. In 1852, Mr. A. Fleming published his observations on the Salt Range in several letters addressed to Sir R. Murchison, Quart Journ. vol. IX. p. 189.

All the fossils collected by Mr. Fleming, Mr. Purdon, Captain G. Austen and Dr. Verchère belong to the carboniferous formation. Captain Strachey alone has proved the existence of more ancient rocks (in a palæontological point of view.)† He sent to London a series of fossils collected in the mountains, from 17 to 18000 feet above the sea, which separate Thibet from the British provinces of Kumaon and Garhwal. I have identified among these fossils some *Asaphus*,

\* Capt. Gordon-Austen and myself visited the localities referred to in the geological notes, during a tour we made together in the autumn of 1863. We thought at one time of writing a memoir in collaboration, but having been sent to the extremes of India, we arranged our notes separately. A. M. V.

† In the present paper are figured a few Cystoids which are in all probability Silurian, see Pl. VIII. fig. 61 and 62.

*Lychnas*, *Ilænus*, *Cheirurus*, *Orthoceras*, &c. all characteristic of the Lower Silurian. In the upper part of the beds Captain Strachey found goniatites, ceratites and even ammonites, which remind one much of the Trias. So far, therefore, two of the four great divisions of the Palæozoic formation have become well known in the Himalaya, viz. the Silurian and the Carboniferous. The Devonian will be found also, for we have received from a Missionary travelling in China three species of *Brachiopoda* characteristic of the Upper Devonian rocks, among others the *Terebratula Cuboides*. These fossils have been presented this year to the Académie de Sciences de Paris. Mr. Davidson has also figured and described, as received from China, *brachiopoda* which also are characteristic of the Devonian, among other the *Spirifer*, Verneuil. The discovery and determination of the Devonian in the Himalaya requires attention and research.

I have further to remark how great is the analogy between India and Russia; I have found in this last country most of the species which Mr. Verchere has found in the Himalaya. Russia, the Oural and the Altai, are connecting links between England and India.

In terminating this note, we wish to observe that if, according to Mr. Verchere, the coal measures, (which should be superior to the carboniferous limestone), are wanting in India, this want is one more resemblance with Russia, for in all the carboniferous zone which extends from Moscow to Archangel the carboniferous limestone is never covered in by coal measures. There has been a slow upheaving motion of the ground, which has raised the strata above the sea-level, without, however, otherwise disturbing them, at the epoch when in other countries, the coal was being deposited. It is in the south of Russia only (the Douetz), and in a few localities on the western slope of the Oural, that coal measure deposits are to be found.

(Signed) ED. DE VERNEUIL.

Paris, 21st Nov., 1864.

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## APPENDIX.

## FOSSILS.

## SILURIAN.

*Sphaeronites* sp. Pl. VIII. fig 5.

Perfectly globular ; covered with small rounded warts sharply defined. The whole shell, between the warts, is pierced with minute pores. No trace of plates ; no mouth nor stalk-scar visible.

Found in the rocky plains at the foot of the Masha Brum, Korakoram Chain.

*Sphaeronites* sp. Pl. VIII. fig 6.

Proposed name of a new species : *S. Ryallii*, Verch.

Globular. Large warts well set apart and not very sharply defined. The whole shell is covered with pores. No mouth. A stalk-stem very conspicuous.

From the same locality as the preceding. Name proposed in honour of Mr. Ryall, Gt. Trig. Survey, who discovered the shell.

*Sphaeronites* sp. Pl. IX. fig. 1.

Depressed. No warts or spines ; no plates or traces of plates, no stalk-scar. The whole surface pierced by minute pores.

Same locality.

## CARBONIFEROUS.

*Zeawan Beds.*

## CEPHALOPODA.

*Nautilus Flemingianus*, DeKon.

Journal, Geological Society, Vol. XIX. Part I, No. 73, p. 15. Pl. VIII. fig. 2. A fragment of this shell was found at Zeawan, Kashmir.

*Nautilus Favranus*, Verch., n. sp.

A very large globular *Nautilus*, eleven inches across the mouth. Perfectly smooth and inornate. Siphon large and central, formed by a series of dilatations, giving it a beaded appearance.

Rotta Roh in the Punjab.

*Orthoceras* sp.

Zowoor and Zeawan in Kashmir.

GASTEROPODA.

*Macrocheilus Avellanoides*, DeKon.

Journal, Geological Society, Vol. XIX. No. 73, p. 10. Pl. III  
fig. 4. Rotta Roh.

*Dentalium Herculeum*, DeKon.

Op. Cit. p. 8. Pl. IV. figs. 10, 11 & 12. Several specimens  
were found in the Rotta Roh, but none in Kashmir.

*Trochus* sp.

Some large specimens of *Trochus*, four inches across, were found at  
the Rotta Roh, Punjab.

LAMELLIBRANCHIATA.

*Anomia Lawrenceana*, DeKon.

Journal, Geological Society, Vol. XIX. p. 6. Pl. IV. figs. 7, 8 & 9.  
Found in the Rotta Roh, but not in Kashmir.

BRACHIOPODA.

*Terebratulæ sacculus*, Martin.

Journal, Geological Society, Vol. XXII. p. 40. Pl. II. fig. 1.  
Found at Zeawan Zowoor and Barus, Kashmir.

*Remark.* A few other species of true *Terebratulæ* were found in  
the Zeawan group of Carboniferous limestone, but I am unable to  
identify them at present.

*Spirifer Vercheri*, de Verneuil, new sp. Pl. I. figs. 1, 1a.

See M. de Verneuil's note.

Barus in Kashmir. It has been found in Spiti.

*Spirifer striatus*, Martin.

Journal, Geological Society, Vol. XVIII, No. 69, p. 28. Pl. I.  
figs. 9 and 10.

Several fragments were found at Zeawan and Zowoor, and complete  
specimens in the Rotta Roh.

*Spirifer Moosakhelensis*, David.

Op. Cit. p. 28. Pl. II. fig. 2.

This shell is extremely abundant at Zeawan, but was always found  
in fragments. It is also common at the Rotta Roh.

After comparing numerous specimens of the last two species, in  
various states of weathering, I must express my impression that the  
*S. Moosakhelensis* is only a variety of the *S. striatus*, in which the

concentric laminæ (which do exist in the striatus) have become exaggerated. All stages of transition are to be observed in a moderately large series.

*Spirifer Rajah*, Strachey [Syn. *S. Keilhavii* Buch ?]

Paleont. of Niti, page 59.

Fragments found at Zeawan and Barus.

*Spirifer*, spec. nov. ? Pl. III. figs. 1 & 1a.

Hinge-line straight and much longer than the greatest width of the shell. Umbones prominent above the hinge-line; hinge-area not seen. Six or seven irregular ribs radiate from the umbo to the margin in a wavy manner. Fine ornamental raised lines (coarser on the larger than on the smaller valve) radiate likewise in a wavy manner. Shell flat. It varies a great deal in shape and size, but is always very flat, so much so that it has somewhat the appearance of such shell as the *Strophomena grandis* of the Silurian. It may possibly be, like the precedent, a variety of the *S. Keilhavii*.

Found at Zeawan in Kashmir and at the Rotta Roh.

*Spiriferina octoplicata* (Sow.), var. *Transversa* (Verch.)

Pl. I. figs. 2, 2a, 2b, 2c, and 2d.

Specimens like *a*, are not common at all; but fragments of the shell such as are represented at *b*, are innumerable in the brown shale of Zeawan. Found also in the limestone of Kafir Kote in the Rotta Roh, but it is there rare. This shell seems to vary wonderfully, from the narrow forms figured by Davidson, (Journal Geological Society, Vol. XVIII. Pl. I. figs. 11 and 14,) to the very transverse variety represented here.

*Athyris* sp. (*Ath. subtilita*. Hall), Pl. II. figs. 1 and 1a.

This species varies considerably, especially as to size, but is easily recognized by the overlapping of the upper edge of the lines of growth, so that the shell looks as if made up of several layers laid one over the other, like the many capes of a coachman's cloak.

Found at Zowoor in Kashmir, in lenticular beds where it appears to be gregarious. Also in the Rotta Roh and Salt Range.

*Athyris Buddhista*, Verch., n. sp. Pl. II. figs. 2, 2a, and 2b.

It has flat, expanded sides on each side of a well marked sinus of the larger valve and sharp fold of the lesser. The beak terminates in a point, occasionally pierced by a small foramen but generally

imperforate. The spiral oral arms appear to fill nearly the whole of the shell, leaving only a small hour-glass-shaped space in the centre.

This shell varies a good deal, some specimens being much more transverse than others, some being very flat and others less so. It was a gregarious animal found now accumulated in lenticular beds.

**Zeawan and Zowoor.** The name proposed is derived from the first few specimens which were found having been discovered in blocks of stone of a Buddhist ruin.

*Athyris* sp. probably *A. Royssii*, (*L'Eveillé*) Pl. II. fig. 3-3.

Less transverse than the preceding and ornamented with fine and closely set concentric lines of growth strongly marked. Foramen generally obliterated. Imprints showing the fringe-like expansion round the margin are very common in the brown shale of Zeawan. The shell is abundant in all the localities where the Zeawan bed has been observed in Kashmir and the Punjab.

*Remark.* Several other species of *Athyris* were discovered at Zeawan, Zowoor and Barus, some having the general facies of our figs. 2 and 3 and being probably varieties of the *A. Royssii*. Others with the umbo-marginal diameter longer than the transverse and being probably narrow varieties of the *A. subtilita*. Others again have the general facies of the *T. Digona*, and others the carinated appearance of the *Ath. Navicula* (Sow).

*Retzia radialis* (Phill), var. *grandicosta* (Davids.)

Journal, Geological Society, Vol. XVIII. p. 28. Pl. I. fig. 5.

Very frequently met with at Zeawan and Zowoor, and also in the Rotta Roh.

*Streptorynchus crenistria*, Phill. var. *robustus*.

Op. cit. p. 30. Pl. I. fig. 16.

This shell attains a very large size in Kashmir and in the Punjab, specimens five inches in transverse diameter not being rare. Fragments of this shell, and young shells, swarm at Zeawan and in some beds in the Rotta Roh.

*Orthis resupinata*, Martin.

Op. cit. page 31. Pl. I. fig. 15.

Abundant in the brown shale of Zeawan, Kashmir.

*Orthis* sp. Pl. III. fig. 3.

A cast of an *Orthis* belonging to the type of the *Orthis plicatula*

(Hall) of the Silurian. It has six ribs, not very conspicuous, and two well-marked lines of growth; and is ornamented with fine radiating striæ. Only one specimen was found at Zeawan.

*Remark.* An immense number of small, or perhaps young, *Orthisidæ* occur in the ferruginous dark shale of Zeawan, in some places so abundantly that they cause the shale to exfoliate like a disintegrating mica-schist. The shells are, however, so thin and brittle that imprints alone can be procured.

*Strophomena analoga* (Phill.) ? Pl. II. fig. 4.

There is, I think, little doubt of this shell being Phillip's species. The shell is raised in irregular concentric furrows and ridges, and is ornamented by fine radiating striæ. Both valves are nearly flat; the umbones are hardly marked; the hinge is linear and nearly as long as the greatest diameter of the shell. These Indian specimens are very large, above four inches across.

Seldom found entire in Kashmir; but even pieces of it are conspicuous and easily recognized. Good specimens were obtained from the Rotta Roh in the Punjab.

*Strophomena* ? sp. Pl. III. fig. 2.

An internal cast only. Found at Zeawan in Kashmir.

*Productus costatus* (Sow.)

Journal, Geological Society, Vol. XVIII. p. 31. Pl. I. figs. 20, 21.

Numerous specimens of this well known species were found at Zeawan and Zowoor in Kashmir, and in the Rotta Roh and Salt Range.

*Productus semireticulatus* (Martin.)

Op. Cit. p. 21.

It varies considerably, some specimens being very transverse. The Kashmir and Punjab specimens are usually very large and often deformed by pressure.

Zeawan, Zowoor, Barus. Rotta Roh, Salt Range.

*Productus cora* (d'Orbigny.)

Found abundantly every where in the Zeawan group.

*Productus Humboldtii* (D'Orb.)

Journal, Geological Society, Vol. XVIII. p. 32. Pl. II. fig. 6.

Large specimens found at Zeawan and smaller ones at Barus. Also in the Salt Range and Rotta Roh, Punjab.

*Productus Purdoni* (Davids).

Op. Cit. p. 31. Pl. II. fig. 5.

Zeawan in Kashmir and Rotta Roh in the Punjab. In a series of specimens of *P. Humboldtii* and *P. Purdoni*, it is quite impossible to decide where one species ends and the other begins.

*Productus Flemingii* (d'Orb.)Syn. *P. longispinus* (de Vern.) and *P. lobatus* (de Vern.)

Journal, Geological Society, Vol. XVIII. p. 31. Pl. I. fig. 19.

Davidson's figure does not show the enrolled and horn-like ears so well defined in our specimens.

M. de Vernueil regards the Rotta Roh specimens as a well defined variety; see his note.

Found at Zeawan and Zowoor and in the Rotta Roh.

*Productus Boliviensis* (d'Orb.) and *P. aculeatus* ? (Martin).

See M. de Vernueil's Note.

Found at Zowoor and Zeawan in Kashmir.

*Strophalosia* ? (*Arachnoides*, Verch.) n. sp. Pl. IV. figs. 1, 1a, 1b.

The specimen of the larger valve is from the Rotta Roh and the other two from Zeawan in Kashmir; they may be different shells. The larger valve resembles the *Productus Purdoni*, but the spines are fewer, better defined and less slanting towards the margin. The other two specimens are remarkable for the excessive length of the thread-like spines and for some complications in the hinge.

## CRUSTACEA.

*Eurypterus* ? *Limulus* ? sp. Pl. V. fig. 4.

Claw of a Crustacean, belonging apparently to one or the other of the two genera above. It was found on a slab which had been worn by running water, so that a horizontal section of the claw is produced. The same slab was full of *Athyris Buddhista* (Verch.), *Productus Flemingii* (D'Orb.), *P. Aculeatus*, *Fenestella Sykesii* (deKon.) and *Vincularia Multangularis* (Patlock).

The tegument is smooth and pierced by pores, which are seen vertically sected on the margins of the claw, and appear like dots where the tegument is not worn off. The tegument forms septa in the upper mandibule, but none in the lower. The ends of the mandibles are hooked. There are no traces of teeth on the internal margin of the claw. No other part of the animal could be found.



## Kashmir.

*Remark.* Another crustacean has been found abundantly in the Carboniferous of the Himalaya. It is a *Trilobite*, with the rings sharp and rib-like. Though common, it has not been found good enough for identification and figure.

Zeawan, Banda and Barus in Kashmir. Also Rotta Roh and Salt Range in the Punjab.

## ECHINODERMATA.

*Cidaris Forbesiana*, (*deKon.*)

Journal, Geological Society, Vol. XIX. No. 73, p. 4. Pl. IV. figs. 1 and 2.

Rotta Roh, but not in Kashmir. There are several species or varieties.

These cidarides will have, I think, to be made into a new genus when better known. They appear to have been borne on long thin branching stalks. The body has not been found yet, but I have found *hexagonal* plates with an articulation cup in the centre, spines four inches long, and stalks of considerable length.

*Crinoid stems* were found in enormous quantity in all the layers of the Zeawan bed. Sometimes the rock is nothing but a mass of rings pressed together. In the Rotta Roh I found a great number of an *Encrinus*, cup-shaped and nearly a foot in height, belonging apparently to a new genus. I cannot describe it at present. It supports a multitude of minute arms and fingers, the debris of which form a glaring-white rock, very conspicuous as one of the layers of the Zeawan bed in the Punjab.

## BRYOZOA.

*Tenestella Sykesii*, (*deKon.*) Pl. IV. bis. figs. 1, a. b. c. d.

Journal I. Geological Society, Vol. XIX. p. 5 Pl. 1 fig. 1.

The colony forms a wavy leaf. The openings of the cells cover the whole surface of the longitudinal bars without assuming a linear arrangement; the transverse bars are barren of cells. The cells are arranged in bundles imbedded in sockets of the support, so that a vertical section along one of the longitudinal bars shows a succession of little cups or sockets, in each of which are collected from six to eight elongated cells, disposed fan-like. The calcareous support between the sockets is massive.

This Bryozoon is extraordinarily abundant in the Zeawan bed. The colonies are often packed one over the other like dead leaves, and I have counted seven and eight colonies in a piece of shale not an inch thick.

*Fenestella Megastoma*, (deKon). Pl. IV. bis. fig. 2, a. b. c. d.

Op. Cit. Vol. XIX. p. 5. Pl. II. fig. 3.

The shape of the colony was not seen. The openings of the cells cover the longitudinal bars, without assuming a linear arrangement. The bars are rounded on the cell-bearing side and are angular on the barren surface. They are hollow or tubular, and the cells are arranged over the roof of the tube, like bricks in an arch, and are not connected in bundles and contained in sockets as in the *Fen. Sykesii*.

*Fenestella*, sp. Pl. V. fig. 1.

Shape of colony not seen, but generally very flat and wavy. The oscules, which are small, are somewhat quadrfangular. It is found mostly as an imprint. Disposition of the cells not seen.

Very abundant at Zeawan, Zowoor, Banda, in Kashmir and also in the Rotta Roh.

*Vincularia Multangularis*, (Portlock) ? Pl. IV. bis., figs. 3, a. b. c. d.

See M. de Vernueil's note.

The colony has a moss-like appearance. The cells are arranged all round a calcareous support, and inclined forwards.

This Bryozoon is extremely abundant in the Zeawan bed, the branches extending in all directions but never anastomosing; their division is nearly always dichotomous. I have seen colonies cover more than a square foot of rock with their ramifications.

*Disteichia* ? (Sharpe). Pl. V. fig. 2.

I am unable to refer it to any genus which I know, unless to the genus *Disteichia* (Sharpe). It is found at Zeawan, but is there rare; in the Rotta Roh it is very common. The layers of cells accumulate one over the other to a great extent, forming occasionally large masses of Coralline rock.

*Acanthocladia*, sp. Pl. V. fig. 3.

The colony has the aspect of a fern. The central stem throws out branches at regular intervals, and at a certain fixed angle, and these branches throughout younger branches. Both stem and branches support short spines like leaflets. The disposition of the cells was not seen, as only imprints of this animal were found.

Found near Banda in Kashmir.

*Phyllopora* ? *Cribellum* (*deKon*).

Journal, Geological Society, Vol. XIX. p. 6. Pl. I. fig. 2.

Fragments are not scarce in the Rotta Roh, but it was not found in the Kashmir beds.

*Retepora Lepida*, (*deKon*).

Op. Cit p. 6. Pl. I. fig. 5.

Several fragments found at Zeawan and in the Rotta Roh.

*Remark.* A few other species, not yet satisfactorily determined, were found in this group.

#### ANTHOZOA.

*Lithostrotion Floriforme*, (*Flem.*).

Beautiful specimens are to be obtained near Bilote in the Rotta Roh. Not found in Kashmir.

*Lithostrotion Irregulare*, (*Phill.*) ?

A *Lithostrotion* which is this species, or a very near ally, is very common in the Rotta Roh. The calyces are long, rounded, irregular cylinders, more or less vermiform in appearance and varying considerably in size in various specimens, but always of nearly the same size in each individual colony.

Very small fragments only were seen in Kashmir, but in the Rotta Roh colonies of this coral attain to great size, forming masses of rock several feet across, and many tons in weight.

*Alveolites Septosa*, (*Flem.*) ?

Journal Geological Society, Vol. XIX. p. 4 Pl. II. fig. 1.

It often forms shapeless masses, the centre of which is converted into flint.

Zeawan in Kashmir and Bilote in the Rotta Roh.

*Michelina*, *sp.*

Rotta Roh. Never found in Kashmir.

*Remark.* The abundance of corals in the lowest beds of the Zeawan division of the Carboniferous at the Rotta Roh is sometimes astonishing. In Kashmir they are rather scarce. We have a few specimens not yet determined.

#### PISCES.

*Saurichthys* ?

Teeth of fishes, large for the genus to which they appear to

belong, were found in Kashmir and in the Rotta Roh. They are conical, but compressed so that the section is an oval; they are strongly striated or rather grooved the whole length. The largest is about three quarters of an inch long.

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*Wean Beds.*

CEPHALOPODA.

*Goniatis Gangeticus*, (deKon.)

Journal Geological Society, Vol. XIX. p. 14 Pl. V. fig. 2.

I had thought at first that this *Goniatis* was more like *G. Henslowii*, Sow.; but better specimens, which I have since procured, leave little doubt that the species found was DeKoninck's shell. Some of the species from the Rotta Roh are much larger than DeKoninck's figure, and some are elliptical.

Found near Banda in Kashmir and near Gung and Oomurkhel in the Rotta Roh.

*Goniatis Curvicostatus*, (Verch.), nov. sp. ?

The species is well characterized by curved ribs, rather coarse and irregular. The suture is like that of the *G. Gangeticus*. Only one specimen, from near Gung; not good enough to be figured.

*Remark.* Several indeterminable *Goniatis* were found near Banda, and at Barus in Kashmir.

*Nautilus Utiellarius*, (Sow.) ?

Fragments very like this species were found near Gung. Two or three other species, indeterminable, were found in the *Goniatis*-bed in Kashmir and at the Rotta Roh.

*Orthoceras*, sp.

A small species, about two inches long and a third of an inch thick, was found in the limestone with *Goniatis Gangeticus* near Gung.

LAMELLIBRANCHIATA.

*Solenopsis Imbricata*, (deKon.)

Journal Geological Society, Vol. XIX. p. 8, Pl. IV. fig. 3.

Found at Koonmoo and in the hills near Mutton and at the Manus Bal, in Kashmir. Also in the Rotta Roh. Good specimens were procured from blocks not in situ, near Bij-Behara in Kashmir.

*Solenopsis*, sp. vel var. nov. Pl. VI. fig. 1. Similar to the preceding

but longer; the anterior end is narrower than the posterior extremity, whilst in the *S. Imbricata* both ends are nearly equal. The imbrication of the lines of growth is strongly defined.

Found with the preceding.

*Cardinia*, sp. (*C. Himalayana*, Verch. nov. sp.) Pl. VI. fig. 2.—(*Anthracosia*, King.) ??

The lines of growth are deeply impressed and imbricated, and the shell bulges a little between these lines. The hinge was not seen.

Animals gregarious; their shells occur heaped together in patches. Manus Bal, Koonmoo, Mutton?, Rotta Roh.

*Cardinia*, sp. (*Cardinia Ovalis*, Martin,) Pl. VI. fig. 3.—(*Anthracosia* King.) ?

A species more elongated than the preceding. Lines of growth similarly disposed. Found with the preceding.

*Cucullæa*, sp. Pl. VI. fig. 4.

A gregarious small shell, sometimes so abundant that it forms masses of rock by itself. Lines of growth well defined, especially near the margin. Hinge not seen. It is perhaps the young of some larger shell.

Found at Wean, Koonmoo and Ishmalabad in Kashmir and in the Rotta Roh in the Punjab.

*Pecten*, sp. Pl. IV. fig. 5.

Small shell, perfectly smooth with the exception of a few lines of growth. It is ornamented with *painted* dark lines, which radiate from the beak to the circumference, increasing in width as they approach the margin. The convexity is very small, and the ears small.

Only one-valve specimens were ever found, through the shell is tolerably common in the reddish limestone of Koonmoo in Kashmir.

Found also in the Rotta Roh ?

*Aviculo-pecten Dissimilis*, (Flem.)

See M. de Vernueil's note.

This and the following *Aviculo-pectens* are apparently identical with the group of animals represented in England by the *A.-Pecten Arenaceus*. They were gregarious and all lived together, and are now found in a sandy somewhat friable limestone, in lenticular beds which are evidently the remains of sandbanks near the shore.

Our specimens of *A.-Pecten Dissimilis* are oval in shape, the

umbo-marginal diameter being the longest. The shell was at first very gibbose, but after the second line of growth it is much less so. Four sunken lines of growth are well marked. Ears small and transversely striated. Shell nearly equilateral, beak prominent.

The cast shows two deep pits, corresponding on the inside of the shell to two tubercles. These pits are more than half way down the valve. The cast is covered with shallow irregular fossæ which correspond to small bosses inside the shell, and are probably due to the presence of pearly matter. There are traces of an epithelium.

Found at Koonmooch, Rotta Roh.

*Aviculo-pecten*, sp. (*A. pecten Ovatus*, Verch.) Pl. VI. fig. 6a, and 6b.

A small specimen, quite smooth. Outline elliptical; convexity trifling; ears meeting above the beak into a straight line.

The inside of the valve shows (b) two strong lateral ridges proceeding from the beak, and terminating about two-thirds down the valve in well defined tubercles. The hinge presents two short rounded ridges or teeth proceeding from the beak for about a quarter of an inch, when they also terminate in minute tubercles.

*Aviculo-pecten*, sp. (*A. pecten Runus*, Verch.,) Pl. VI. fig. 7 and 7a.

Outline sub-circular; shell very flat; ears irregular. The whole valve is covered with fine radiate striæ, and with thin lines of growth. Shell thin. Internal cast not found. It is perhaps the *P. Crenisteria* (de Koninck.)

*Aviculo-pecten Circularis*, Verch., Pl. VII. fig. 1a. and 1b.

Outline of shell sub-circular, rather transverse. Shell moderately convex; concentric striæ faintly seen. Lines of growth irregular and un conspicuous. The cast (b) presents two deep pits which are continued by a groove towards the beak, corresponding on the inside of the shell to two muscular tubercles and ridges. The ridge is much more defined posteriorly than anteriorly. Lines of growth strongly marked on the cast? No pearl fossæ. It may be a variety of *P. Ellipticus* (Phill.) ??

*Aviculo-pecten*, sp. Pl. VII. fig. 2a & 2b.

Outline pyriform, umbo-marginal diameter the longest. Moderately gibbose; beak much incurved and somewhat imbedded in the ears, which meet above it in a straight line.

The cast only was found. It shows two strongly marked lines of growth well set apart. No pearl-fossæ on cast.

\* The inside of the shell, (b) shows two ridges proceeding from the beak but not terminating in tubercles (at least not on one side; the other side was not seen). Two small teeth in the hinge terminate by minute tubercles. Beak grooved by a canal or foramen. Inside of ears concave.

*Aviculo-pecten Testudo*, Verch. Pl. VII. fig. 3 and 3a.

Shell pyriform, umbo-marginal diameter longest. Extremely gibbose. Beak pointed; ears meeting above in a straight line. A few concentric striæ. Lines of growth un conspicuous, excepting one near the margin.

*Aviculo-pecten Gibbosus* Verch. Pl. VII. fig. 4 and 4a.

Outline sub-circular, transverse. Shell enormously gibbose, especially as far as the second line of growth. Shell inornate. Lines of growth shallow and confused. Ears meeting in a line above the beak. Shell thick.

*Remark.* These *Aviculo-Pectens* were found in Kashmir in the Wean groups only; but in the Rotta Roh they have been found here and there mixed with shells of the Zeawan group, such as *P. Semireticulatus*, *A. Subtilita*.

*Axinus*, nov. spec. conf. *A. Obscurus*.

See M. de Vernueil's note.

Found with the *Aviculo-Pectens*.

#### BRACHIOPODA.

\* *Spiriferina Stracheyii*, (Salter.)

Paleontology of Niti, page 72, Pl. IX. fig. 13.

This shell is not rare in the Wean group near Koonmoo; in some beds it swarms in company with a small *Terebratula*. We have two varieties, one like Mr. Salter's figure and another higher and narrower. Some specimens show plainly to the naked eye the punctate structure of the shell.

POST-SCRIPTUM. *Productus Lewis*, (David.) T. Geol. Soc. Vol. XXII. p. 44, Pl. XI. fig. 16, and *Spirifera Barusiensis*, (David), Op. Cit. p. 42, Pl. XI. fig. 7.

Both these shells are found in the Wean limestone near Koonmoo, and at the Rottah Roh in the flaggy limestone with *Goniatites Gangesicus*. I have not found them in the Zeawan group, except at the Rotta Roh in the mixed beds.

# TRIAS (MIDDLE AND UPPER.)

## Kothair Beds.

In the text I considered provisionally the Kothair group as either the uppermost layer of the Carboniferous, or else Permian or Triassic. I had no fossils then to decide the point. During the time which has elapsed between my first sending in this paper and its publication I have found, in breaking up some rocks from the Kothair bed in Kashmir, a *Globosus* with *Ceratite*-like sutures; and I have discovered in the Rottah Roh, in beds corresponding to the Kashmir bed, a few shells which do not leave a doubt of this group being Triassic.

## CEPHALOPODA.

*Ammonites*, sp. conf. *A. Gaytani* (Klip.)

Paleont. of Niti, p. 65, Pl. TII. fig. 4.

Our specimen is a little more than half an inch across, and very globoso. It shows well two or three of the sutures which are identical with Mr Salter's figure.

From the Upper Bed, near Banda in Kashmir.

*Ceratites Semi-partitus* (Gaillardot.)

A very good and nearly complete specimen was found in the Rotta Roh, in a pale limestone which forms a high cliff above the much disturbed Carboniferous. The shell is slightly elliptical. The suture is exactly like that represented in Pictet's *Traite de Paléontologie*. It has some resemblance to M. de Koninck's *Ceratites Lyellianus* or more still to his *C. Lawrencianus*, but the suture differs. Cliffs above Kotela and Oomurkhel, Rotta Roh.

*Remark.* I have but little doubt that several of the *Ceratites* described by Mr. de Koninck (from Dr. A. Fleming's collection), as obtained from Carboniferous beds with *Spirifers* and *Producti*, had their situs in those cliffs or similar ones, and had dropped and become mixed with the much broken up and fragmentary rocks of the Zeawan and Wean groups below.

*Ceratites Nodosus* (Sow.)?

On a slab of reddish calcareous sandstone from the Alged Wan, Rotta Roh, a shell, which has all the characters of this species, is to be seen in company with the *Posidonomya* to be hereafter described, with fragments of bone and what appears to be a tooth of *Lepidotus* (?)



## GASTEROPODA.

*Natica*, *sp.*

Like *N. Subglobulosa* (Kl.) Pal. Niti, p. 68, Pl. VIII. fig. 12.

Only sections and outlines were seen on the weathered surface of rocks. Very abundant in the upper beds at Banda and at Kothair in Kashmir.

*Macrocheilus*, *sp.*

Sections and outlines of a shell of this genus are very abundant at Sono Murg and Kothair.

*Nerinæa*, *sp.?*

Small shells with a raised spot in the centre of each half-whorl.

*Pyramidella* or *Loxonema*?

Several specimens of this fine *Pyramidella* were seen on the weathered surface of the sandy limestone of the patch of Kothair rock near Koonmoo.

## LAMELLIBRANCHIATA.\*

*Posidonia* *conf. P. Minuta*.

Minute shells of this genus, with well-marked concentric striæ, were found in the sandstone containing the *C. Nodosus*. Algerd Wan, Rotta Roh.

Outlines of small bivalves are very abundant on the weathered surface of the rocks at Sono Murg and Kothair, but the shells cannot be extracted.

## ECHINODERMATA.

*Peptacrinites*, *sp.?* Pl. VIII. fig. 1.

Starry rings of Encrinite stems are very abundant in most of the arenaceous limestone of the Wean groups, and also in the rocks of the Kothair groups at Sono Murg and Kothair in Kashmir.

## ANTHOZOA.

*Cyathophyllum*, *sp.*

Abundant on the weathered surface of Kothair-rocks.

*Cyathophyllum*, *sp.*

Same remark as above.

*Cyathophyllum*, *sp.*

Generally found as figured at (a). Found as represented at (b) near Martand, Kashmir.

*Remark.* Several small species of corals were seen in the Kothair limestone in Kashmir but in a very bad state of preservation.

## LIAS (LOWER.)

## CEPHALOPODA.

*Ammonites Tubar* (Strachey.)

Pl. Niti, p. 32, Pl. 20 fig. 2 a—c and Pl. 21 figs. 1 a—c.

Three good specimens of this shell showing well all the characters and the suture, as represented by Mr. Blanford.

From a muddy and sandy brown bed, very sparingly calcareous, in the Chichali pass near Kalabagh, Punjab.

*Ammonites*, sp.

Pal. Niti, Pl. 19 fig. 3 a, 6 and c.

The figure in the Palæontology of Niti is exactly like our shell; it is not described in the text and not named. It resembles a little the *A. Striatulus* (Sow.).—Found in the same bed as the preceding.

*Belemnites*, sp.

A coarse species when full-grown, with a well marked front sulcus, and often a back one also. The section is oval.

From the same bed as above in Chichali and from some brown sandstones under the Oolite at the foot of Sheikh Bodeen near Tora Obo.

POST-SCRIPTUM. I find this species described and figured by Mr. Stoliczka, (Sections across Himal., Mem. Geol. Surv. of India, Vol. V. Part 1, fig. 78, Pl. VIII fig. 1-4,) under the name of *B. Bisulcatus* (Stol) from the lower Lias of Spiti.

## LAMELLIBRANCHIATA.

*Gryphæa Arcuata* (Lam.)

Some specimens, from the Chichali pass and the same bed as the *Ammonites*, belong certainly to this well-known species.

*Astarte*, sp.

A very circular *Astarte* from the same bed, Chichali.

## OOLITE (OXFORDIAN).

## CEPHALOPODA.

*Ammonites Biplex*, Sow.

Journal Asiat. Soc. No. 2, 1863, p. 129, Pl. II., fig. 5 and Pl. III. figs. 4 and 5.

*Ammonites Strigilis*, Blanford.

Op Cit. p. 126, Pl. III figs. 1 and 1a.

Five fragments showing well the single ribs bending forwards.

• *Ammonites Triplicatus*, Sow.

Pal. of Niti, p. 80, Pl. 13 fig. 1.

*Ammonites Scriptus* (Strachey).

Pal. of Niti, p. 81, Pl. 16, fig. 2.

*Ammonites Guttatus* (Strach.)

Op. Cit. p. 79, Pl. 13; fig. 2.

*Ammonites Wallachii*, (Gray.)

Op. Cit. p. 84, Pl. 15, fig. 1 and Pl. 19, figs. 1 and 2.

All these Ammonites are from the Inferior limestone bed of Shaikh Bodeen in the Punjab.

*Belemnites Sulcatus*, Miller.

Journal Asiat. Soc. p. 125, Pl. 1, fig. 1.

Very abundant in the Ammonite bed at Shaikh Bodeen. Rarer in the beds above.

*Belemnites Canaliculatus*, Sch.

This is perhaps a variety or a younger shell of the above. Found in the same beds.

*Remark.* One or two more species of Belemnities were found with the preceding at Shaikh Bodeen.

#### GASTEROPODA.

*Acteonina*, sp.

In all beds, Shaikh Bodeen.

*Turbo*, sp. and *Scoliostroma*, sp.

Both in Ammonite-bed, Shaikh Bodeen.

*Natica*, sp.

Same locality.

#### LAMELLIBRANCHIATA.

*Pecten Arcuatus*, Sow. ?

Not unlike *P. Comatus*, Munster, (Pal. Niti, Pl. 22, fig. 9). It is more strongly ribbed than Salter's figure of the *P. Comatus* and it is flatter, thus answering perfectly the description of the *P. Arcuatus*.

Ammonite-bed, Shaikh Bodeen.

*Hinnites Tubulipora*, Verch., n. sp.

Like *Spondylus Tuberculosis*, Goldf., but the ribs of our species are much coarser, fewer, and more foliated and the tubular spines are larger, more in number, and rather lamellar.

It is not rare in the Ammonite-bed, Shaikh Bodeen.

*Homomya (Pholadomya) sp.* ;

We have three species of *Pholadomya* without rays from Shaikh Bodeen.

*Pholadomya (Ph. Semireticulata, Verch. nov. sp.)* Pl. IX. fig. 2.

This pretty shell is mostly found as a cast. It is not rare in the Oxfordian bed and extends to the Corallian above.

*Pholadomya (Ph. Quinque-costata, Verch., nov. sp.)* Pl. IX. figs. 3 and 3a.

Ammonite bed, Shaikh Bodeen.

*Plagiostoma sp. conf. P. Consobrina (D'Orb.)*

Ammonite-bed, Shaikh Bodeen.

*Ostræa Gregarea, (Sow.)*

Several specimens found near the Ammonite-bed, Shaikh Bodeen.

*Ostræa Marshii, (Sow.)?*

Same bed as above.

*Ostræa Flabelloides, (Desh.)?*

Fragments similar to Pal. of Niti, Pl. 22, fig. 1, found in the Ammonite-bed, Shaikh Bodeen.

*Ostræa conf. O. Deltoidea, (Sow.)?*

The only difference between our specimens and the figures of this species is that our *Ostræa* have the muscular impression very strongly marked, forming a regular pit with a ridge round it.—From the same bed as the above.

*Ostræa like O. Nana, (Sow.)*

In nearly all the beds, Shaikh Bodeen.

*Ostrea sp.*

A large flat circular oyster, very common in some of the lowest oolitic beds at Shaikh Bodeen.

#### BRACHIOPODA.

*Terebratula Globata, Sow.,* Pl. IX. fig. 4.

Extremely abundant in the Ammonite-bed and in all the beds near it, at Shaikh Bodeen. It varies considerably.

POST-SCRIPTUM. The *T. Gregaria*, Suess, (Memoirs of Geol. Surv. of India, Vol. V. Part I. page 68, and *T. Tibetensis*, David, Journ. Geol. Soc. Vol. XXII. p. 37, Pl. I. fig. 11—14, appear to be the same species.

*Terebratula Bodeenensis, Verch., nov. sp. or var.;* Pl. IX. figs. 6 and 6a.

It is very perfectly oval and varies but little in shape. It has, in most specimens, neither sinus or folds, and the line of junction of the valves forms a nearly perfect curve in front. In a few specimens there is a very trifling undulation of this line. The absence of sinus and fold distinguishes from the *T. Globata*; it is also a smaller shell, but yet may be only a variety of it. Found with the above.

*Terebratula Carinata*, Lam.

Pal. of Niti, p. 99, Pl. 21, fig. 5. .

Our specimens are much more like the *T. Carinata* than the figure in Pal. of Niti. It varies considerably, but the shallow sinus is always well marked. Our specimens are larger than the Niti ones.

Shaikh Bodeen, with the other *Terebratulæ*.

*Terebratula Numismalis*, Lam.

Op. Cit. p. 99, Pl. 21, fig. 4.

Several specimens showing well the depressed aspect of the front of the greater valve, and the well-marked concentric lines of growth.

Ammonite-bed, Shaikh Bodeen.

*Remark.* Two or three specimens not yet identified were found in the same beds, together with a *Waldheimia* rather globular and of the type of *W. Impressa*, Bach, of the Oxford clay.

*Rhynchonella*, sp. (*R. Concinna*, Sow. ?) Pl. IX. figs. 5, 5a. and 5b.

See also Pal. of Niti, Pl. 21, fig. 8.

It has generally, but not always, the sinus better marked than in the Niti figure. Very common at Shaikh Bodeen in nearly all the beds.

*Remark.* Six other species of *Rhynchonella* have been found at Shaikh Bodeen, but are not yet satisfactorily determined.

#### BRYOZOA.

*Eschara Asiatica*, Verch. n. sp. ?

A fenestella-like *Eschara*, appearing in large flat and undulated plates on the surface of the rocks. In the Ammonite-bed, Shaikh Bodeen.

Among the corals, a *Fungia* somewhat like the *Fungia Coronula*, Goldf., but too much worn to be identified, and a *Meandrina* like *M. vel. Comoseris Vermicularis* (Edw and Haime), were found in the Ammonite bed at Shaikh Bodeen.

## OOLITE (CORALLIAN.)

## CEPHALOPODA.

• *Belemnites Canaliculatus*, (Sch.)

Upper Bed, Shaikh Bodeen and Mari-on-Indus, Salt Range.

## GASTEROPODA.

*Nerinea conf. N. Goodhallii*, (Fitton.)

Fragments and sections of this shell are very common in the upper beds at Shaikh Bodeen. The section of the whorls is precisely similar to the figure in Lyell's Elements, p. 304.

## LAMELLIBRANCHIATA.

• *Astarte Scalaria*, (Roemer.) ?? vel *A. Lamellosa*, (Roem.)—

An *Astarte* with lamellous concentric lines, referred to the species above from description only, as I have never seen a specimen or a figure of these species.

Upper beds, Shaikh Bodeen.

## ANTHOZOA.

*Thamnastræa sp.*

Upper bed, Shaikh Bodeen and near Palusseen, Wuziristan.

*Thamnastræa sp.*

A minute species found with the preceding at Shaikh Bodeen.

*Tsastræa sp.*

Much like the *T. Oblongata* (Edw. and Haime.)

Upper beds, Shaikh Bodeen.

*Tsastræa sp.*

Another species from Mari-on-the-Indus.

*Thecosmilia Annularis* (Edw. and Haime.)

Upper bed, Shaikh Bodeen and Mari-on-Indus.

• *Meandrina sp.*

Mari-on-Indus.

*Eunomia sp.*

Mari-on-Indus.

*Rhizangia sp.*

Mari-on-Indus.

*Areacis sp.*

Wuziristan.

*Lobocænia sp.*

A very pretty, spreading specimen from Wuziristan.

*Turbinolia* sp. ?

From Palussen, Wuziristan.

#### ROCK SPECIMENS.

Pl. X. figs. 1 and 1a.

Amygdaloidal greenstone with gas-vents branching through the mass. Abundant in the Zebanwan in Kashmir. Found also amongst the rolled stones of the torrents which drain the Afghan mountains.

Pl. X. figs. 2 and 2a.

Trachyte with starry crystals of dull white albite for which I have proposed the name of *Soolimanite*. From the Tukht-i-Sulaiman in Kashmir.

#### EXPLANATION OF PLATES.

##### Pl. I.

*Spirifer Vercheri*, (de Verneuil), n. s. Natural size.

*Spiriferina Octoplicata* (Sow.) Var. *Transversa*, (Verch.), natural size.

##### Pl. II.

*Athyris* sp. (*A. Subtilita*, Hall.)—natural size.

*Athyris Buddhista*, (Verch.), nov. sp.—natural size.

*Athyris*, probably *A. Royssii*, (L'Eveillé)—natural size.

*Strophomena Analoga*, (Phill.) ?—half natural size.

##### Pl. III.

*Spirifer* sp. ? (Var. of *S. Keilhavii*, (Buch.) ?—natural size.

*Strophomena* sp. ?—natural size.

*Orthis* sp.—natural size.

##### Pl. IV.

*Strophalosia* ? *Arachnoidea*, (Verch.), n. sp.—natural size.

*Fenestella Sykesii* (DeKon).

*Fenestella Megastoma* (DeKon).

*Vincularia Multangulari*, (Portlock).

##### Pl. V.

*Fenestella* sp.—natural size.

*Disteichia* ? ? sp.—natural size.

*Acanthocladia* sp.—natural size.

*Eurypterus* vel *Limulus* ? sp.—natural size.

## Pl. VI.

*Solenopsis* sp.—natural size.

• *Cardinia Himalayana*, (Verch.), n. sp.—natural size.

*Cardinia Ovalis*, (Martin), ?—natural size.

*Cucullæa* ? sp.—natural size.

*Pecten* sp.—natural size.

*Aviculo-pecten* sp. (*A. pecten Ovatus* Verch.)—natural size.

*Aviculo-pecten* sp. (*A. pecten Planus*, Verch.)—natural size.

## Pl. VII.

• *Aviculo-pecten Circularis*, (Verch.)—natural size.

*Aviculo-pecten* sp.—natural size.

*Aviculo-pecten Testudo*, (Verch.)—natural size.

*Aviculo-pecten Gibbosus*, (Verch.)—natural size.

## Pl. VIII.

*Pentacrinite* ? sp.—natural size.

*Cyathophyllum* sp.—natural size.

*Cyathophyllum* sp.—natural size.

*Cyathophyllum* sp.—natural size.

*Sphæronites* sp.—natural size.

*Sphæronites Ryallii*, (Verch.), nov. sp.—natural size.

## Pl. IX.

*Sphæronites* sp.—natural size.

*Pholadomya Sesquireticulata*, (Verch.), nov. sp.—natural size.

*Pholadomya Quinque-costata* (Verch.), nov. sp. natural size.

*Terebratula Globata*, (Sow.)—natural size.

*Rhynchonella Concinna*, (Sow.) ?—natural size.

• *Terebratula Bodeenensis*, (Verch.), sp. vel var. nov.—natural size.

*Amygdaloid* with gas-vents—natural size.

*Soolimanitæ*.





leave the subject, therefore, to those who advocate the loan alphabet, it notice. I may observe, however, that even if it be possible to prove its possibility, it will make but small progress in supporting the conjecture that the Eastern Arians never had any cerebral letter in their language. The Sanskrit has for its basis between 18 and 19 hundred verbal roots, which, by an ingenious series of inflections, agglutinations, affixes and suffixes, produce the entire vocabulary of the language. Now, out of these 1800, 335 roots have the contested cerebral letters; 182 of which have the consonants exclusive of r, 116 end in sh, and 37 in ri, or ri. If the loan-theory were admitted, it will have to be proved that the Brahmins, though conquerors and the more civilized of the two, had to borrow one-fifth of their verbal roots from the despised aborigines, and that too at a time when the Rig Veda hymns were first sung by the ancient Rishis. This is a feat which, in the present state of philology, will not be easy of accomplishment."

Mr. Bayley said, that he could not but regret that the whole of the evidence on which the theory of Mr. Thomas was based, was not before the Society. It was of course impossible fully to judge of the merits of that theory until this was the case. Mr Thomas's propositions were in fact two in number;—1st, that the Aryan race generally, and the Indian branch of it in particular, borrowed and did not invent their alphabets; and secondly, that the particular Indian alphabet, of which the earliest form was that known popularly as the "Lath" character, was borrowed from the Dravidian races which were in occupation of India or part of it, before the advent of the Brahmins. Now he thought, that at least the grounds on which the first proposition was based, were to some extent apparent. It was not, as Baboo Rajendra Lal seemed to suppose, based solely on the argument that the Aryan race having clearly borrowed alphabets in some cases, necessarily to be considered incapable of originating one for  
 4. Rajendra Lal indeed did not deny that the Aryans had alphabets from the natives whose countries they overran, an undeniable instance of this action on their part, was their of the arrow-headed character.

Mr. Bayley understood Mr. Thomas's assumption, however, it was at least based on better grounds than Baboo Rajendra Lal's assumption of immaturity.



n already sufficiently organized and powerful to overrun its neighbours, starts on a career of conquest, and, having as yet no alphabet of its own, occupies countries where an alphabet is already established, it was *a priori* improbable that it should take the trouble of inventing one of its own. Of course, it did not follow, as Rajendra Lal pointed out, that because the earlier Aryan hordes possessed no alphabet of their own invention, that this was necessarily the case also with later hordes, issuing from the same stock and the same "nidus," but there was a strong antecedent improbability that a race which certainly at a comparatively late period of the world's history possessed no alphabet, and was then surrounded by neighbours who did, neighbours with whom, by conquest, some sort of intercourse must have been established,—should nevertheless invent rather than adopt an alphabet. Ceasing, however, to argue from pure probabilities, there was, Mr. Bayley thought, some external evidence for concluding that the Lath alphabet was *not* an Aryan invention, but adopted.

It was not the *only* alphabet used by the Aryan race in India: at the earliest date which could be assigned probably to any Lath inscription, there was another character which Mr. Bayley would call the Bactro-Pali, equally well established in Northern India, and employed to express what might be called identically the same language.

In Northern India, including Cabul, it might be said that this alphabet reigned supreme; south of the Jumna on the other hand was the region of the Lath character and its branches. Intermediately between say the Jumna and the Jhelum was a tract of debateable ground, in which however, at the early date above mentioned, the Bactro-Pali certainly predominated on one inscription; and many coins belonging to this tract are however certainly bi-literal, expressing absolutely the same words in both characters.

If it be supposed that a later emigration of the Aryan race, leaving its cradle after the invention of the Lath character, carried it with them to Central and Southern India, one or other of the following two several suppositions must necessarily be accepted; neither of which seemed at all probable in itself or supported by any evidence.

If, for example, it be supposed that the whole of the Indian Aryan branch quitted its original resting-place together, then it must be supposed that one portion abandoned its native alphabet and adopted

one that it found existing, or that, discarding its own alphabet, it arbitrarily invented one totally different, while the rest of the horde, pressing on southwards, retained and cherished their own.

If, on the other hand, the two branches be looked upon as two separate emigrations, one before and one after the supposed invention of the Aryan Alphabet, then we are to suppose that, passing through countries settled by their own race, speaking their own tongue but using an adopted alphabet, the southern branch of the Aryans yet carried to their own remoter settlement, and preserved there, their newly invented character. Improbable as this latter supposition was, it was rendered still more so by the fact that the two alphabets gave expression to identically the same language; and it was not likely that a second emigration, coming forth from its parent root after the lapse of time necessary to perfect the invention and use of an alphabet, and after the great social change effected by the conversion of a spoken into a written alphabet, should carry with it identically the same language as the earlier emigration.

There remained another possible supposition, which had not been noticed by Rajendra Lal, *viz.*, that one or both of the two alphabets were invented by the Aryan race after they reached India. But in the first place, it is impossible to believe that the same people setting about to invent an alphabet, should have invented two totally different, or that if one was borrowed from existing sources, they should set about to invent another while one was existent and ready to hand.

Lastly, as a matter of fact, the Bactro-Pali at least was pretty clearly borrowed: it was closely allied to,—in some forms and in its modes of numeration, almost identical with,—certain Semitic forms of writing of very great antiquity, which were once in use on the shores and in the islands of the Mediterranean.

Practically, therefore, there was located in India an Aryan race, using a language which is in fact common to all its tribes, a fact which may be accepted as showing that they entered India at dates not very remote, or under very different circumstances. Of this branch the Northern portion, when settled on the road which the rest of the tribes must have traversed on their way towards Central and Southern India, used a borrowed character; and the most probable inference seems to be that the character used by the other is

borrowed also: that, in fact, both adopted the indigenous character which was found already existing in that portion of India in which they settled.

This inference was further strengthened by the fact that both these alphabets, at the earliest date to which we can ascribe their use with any certainty, were not wholly fitted to express all the sounds of the Aryan language which they embodied, and that, in fact, at later dates, we find both characters modified into a more convenient form. Mr. Bayley meant to allude especially to the use of reduplicate and compound letters, which are sparingly and awkwardly combined in the earlier inscriptions, while in later inscriptions (and this is peculiarly the case with the Bactro-Pali) new compounds, nay, it may be said, almost wholly new symbols are gradually introduced. Although therefore the Society had not Mr. Thomas's evidence before it, it seemed at least probable that he was correct, to the extent of assuming that there is no evidence that the Aryan race ever invented an alphabet; but that on the other hand it is certain that they borrowed the alphabets of other nations on more than one occasion, and there is strong presumption that their Indian branch borrowed the Lath character.

But from whom did they borrow it? It was very unfortunate that there was not any portion of Mr. Thomas's case before the Society on this point, nor did the Society know upon what proofs he bases his presumption that the "Lath Alphabet was of Dravidian origin."

On the other hand, the Society are obliged to Baboo Rajendra for the, no doubt, very strong grounds which he had stated for believing that the Dravidian races had no alphabet; nor could Mr. Bayley, so far as his experience went, find any evidence in contradiction of it. Remains presumably belonging to pre-Aryan races were occasionally discovered, but so far as Mr. Bayley was aware, no sort of inscription existed among these. Again, in Southern India, Mr. Walter Elliot reported that, at a comparatively late date, one branch of the Dravidian race maintained itself in independence, and possessed a considerable share of importance, power and wealth. Coins even were attributed to this tribe, but apparently nothing written or inscribed had survived them. Nor, so far as Mr. Bayley was aware, did any purely indigenous Dravidian literature exist; any thing at least of a nature inconsistent with the idea of its being handed down by oral tradition.

So far therefore as the case stood before the Society—it seemed as if, while there was a strong presumption, at least, that the “Lath” character was borrowed by the Aryans and not invented, it seemed at least doubtful if it had a Dravidian origin, and its invention was still obscure.

Mr. Bayley would, however, venture on a guess at a source, from which there was some possibility perhaps that this character had been derived; but, in doing so, he did not venture either to put forth the suggestion with any confidence, nor was it one to the authorship of which he could lay claim. The subject had been touched upon both by the late Sir Henry Elliot and by General Cunningham, and the latter indeed had, he believed, investigated it to some extent, and might possibly give the result of his enquiries to the world.

The great Sanscrit Epic spoke of a race of “Snakes” at enmity with the Aryan race, and indeed allusions to them occur repeatedly elsewhere both in the books and the traditions of the Hindus. Who these Snakes might be, was not the present question; it had been attempted to identify them as Scythian, and for present purposes Scythian was as good a name by which to indicate them, as any other.

Now it was curious that the most Archaic form of the Lath character (as had been pointed out by General Cunningham,) was found on certain coins which bore the emblems and the names known to have belonged to this Snake race. Taking this hint, Mr. Bayley would venture to throw out a few others. The Snake race was not confined to India alone: on the contrary, traces were found of it almost everywhere in the Western part of Asia and in Eastern Europe. The well-known story of Zohak had been supposed to indicate the conquest of Persia, of “Iran” proper, by this Snake race or some wave of it. The subject was a wide one and open to infinite inquiry and research. But the points which were more immediately of interest related to the presence of this race on the northern shores of the Euxine and in the upper parts of Greece. Herodotus, it might be remembered, spoke of the Cimmerians as displaced from mere pressure, on the upper part of the Euxine, by an irruption of Scyths, the offspring of Hercules and a woman half a snake. Again the *Νεῦροι*, a tribe allied to the Scythian, were, a generation before Darius, similarly driven away from their original site by Snakes, partly coming from the North, partly bred among themselves; and it was curious that Kadmus, the

traditionary inventor or introducer of the Greek alphabet, was also a slayer of the serpent, that is, was at least in hostile contact with the serpent race; and perhaps the singular legend of the sowing of the serpent's teeth may be explained as an example of a custom, probably of remote antiquity, but of which familiar modern instances were to be found in the institutions of the Janissaries and Mamelukes—the custom, that is, of forming military bodies of male children captured from the enemy in war.

There was on this occasion no time to follow out this subject, nor did Mr. Bayley consider himself justified in anticipating the results of General Cunningham's researches; but he believed that it was probable that these would show a strong similarity, not merely in names, but in customs and religion, as existing in these regions which the western Snakes appear to have trod, with the traces of the same nature which they have left behind in India. And as regarded the Grecian alphabet, without entering into the arguments which had been assigned in support of its Phœnician origin, Mr. Bayley would only remind the Society of the strong impression which the resemblance between the Greek and the Lath alphabet made on the minds of the first decipherer of the latter, the late James Prinsep; and at any rate it was curious that in Greece, as in India, the long vowels and especially the double letters seem to have been added to facilitate the proper expression of Aryan sounds, proving that it was, at least in its first stage, not fully adopted to the requirements of an Aryan language, and was therefore evidently not originally invented to meet these, but was probably borrowed.

Mr. Campbell said that he had supposed Mr. Bayley to speak of the Snake races as distinguished from the early Aryans, in a way which might lead to the supposition that those Snake races were not Aryans. Now the term was chiefly applicable to the Rajpoots and Jats and cognate tribes, and he thought no one could see these peoples, and doubt for an instant that they are Aryans of the very highest type. At the same time, these people have not generally had very literary tendencies, and it might be questionable whether they invented an original alphabet. The whole question, however, of the first invention of the alphabet used in India, seemed to him to merge in a much better one, not yet solved, viz. what were the first religious civilizations.

in India. If it were the fact, that the early Aryans, with their beliefs in gods descending from above, and in the firm existence of a golden age and a higher state from which man descended, were met by another faith already established in India, by a school holding the doctrine of the progression of races from below upwards, and from which both the Sivite and the Buddhist forms have sprung, then it may be that the earliest Phonetic alphabet was in the possession of this latter school. That the aboriginal Dravidian savages should have invented either the religion or the alphabet, seemed to him to be out of the question. They must have come from some foreign source. The question remained, what was that source? ●

Mr. Bayley explained that he had used the terms "Scythian" and "Aryan" merely as concise forms of expression, and without any intention of assigning an ethnologic character to the Snakes.

Bábu Rájendralála Mitra was glad to find that Mr. Bayley concurred in the main with what he had said in regard to that part of the question to which he had confined his attention. He was well aware of more than one alphabet having been current in different parts of India, in writing down one language, in the time of Asoka and for some centuries after it, but it did not at all serve to throw any light on the question at issue, viz. the source whence the Arians first got their alphabet. The researches of the learned Dr. Goldstücker had clearly established that Páṇini lived many centuries before the age of As'oka, and at his time the art of writing was well known. The root *likh* "to write" (*aksharavinyás'e*) in his *Dhátupáṭha* was conclusive on the subject, and the question therefore was, what was the alphabet that great grammarian and his predecessors used? was it the Bactrian, or the Pali, or any other which has been replaced by the latter? There were not data sufficient to give a positive answer to this; but he felt no hesitation in giving a negative one, as regard the Bactrian. All northern languages, or rather those of cold regions, are noted for gutturals, aspirates, troublesome combinations of consonants, and distinctions of long and short vowels, which Byron well describes as the

" — harsh, grunting guttural,

Which we have to hiss, spit and sputter all."

These, when transferred to hot countries, soon lose their sharpness and become soft and sweet. The history of the Sanskrit language

proves this most incontestably : the sharpness and harshness and the peculiar distinctions and combination of sounds of the Vedic dialect are nowhere to be met with in the Sanskrit of the time of Buddha, and the Sanskrit of Buddha's time was not what it became in the time of Kálidása. It underwent many changes, and most of those changes were dictated by a desire to rub off the asperities of the Vedic language for the sake of euphony.

Now, *a priori*, it would be expected that an alphabet designed for the earlier Sanskrit, or the language as current in the Arianian provinces, would be richer in letters than in one got up in the time of Buddha, for a great deal more stress was laid on minor distinctions of pronunciation in the pre-Vedic and the Vedic, than in later ages ; and when the first idea of alphabetic writing is once formed, no nation can be believed to be so slow as not to be able to design a sufficient number of letters to meet all their requirements. The Bactrian is avowedly not so full. Its vowels are few and imperfect, and consonants deficient ; and it could not therefore have been originally used for a language most remarkable for its long and short vowels, to which it attached so much importance.

Again, it was unknown in the history of language, that a nation, themselves conquerors, voluntarily gave up an alphabet with which their religion was most intimately associated for many centuries, and adopted an alphabet from a conquered people, because of "its superior fitness." No amount of superiority can have any influence in such cases. But he knew not what the superiority was in the case of the Pali. It was not one of easy writing, for the flowing Bactrian has, in that respect, great advantages over the angular Pali ; nor of fulness, for it is avowed that it had no aspirates at all, before the Brahmins adopted it. But were it otherwise, still he doubted if such adoption were possible, after a language had been associated with a particular form of writing for a long time. The English vocalic system was imperfect in many respects, and some of its letters were obliged to do duty for half a dozen sounds, and yet it was not to be for a moment supposed that it would ever be replaced by the most perfect system of writing that is current in the world, the Sanskrit. Besides the Sanskrit was a dead language in the time of Asoka, and had been replaced by the Pali which dropped the aspirates and some of



the sibilants, and rejected the distinctions of long and short vowels; and that, or a little before that, was not the time when the Brahmins would forsake their ancient alphabet for a foreign one, for the sake of its superior and more perfect system of vowels and aspirates.

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Mr. Campbell read a letter from Col. Phayre, Chief Commissioner of British Burmah, inclosing a list of words of the Mon or Talain language of Pegu and Tenasserim, prepared by the very best scholar of that language, the Rev. Mr. Haswell, in accordance with the list of test words sent to Col. Phayre; also promising a similar specimen of the Andamanese language. Col. Phayre added, "The study of the tribes in the hills of Burmah is one of vast interest to the Philologist, to the Ethnologist, and to the Missionary; they may be said to be unknown, at least the majority of them."

Mr. Campbell then said that although he could not pretend to have critically studied the list of Mon words which he had only just received, he could not resist the earliest opportunity of stating that at the very first glance, the first few words in the list seemed at once to establish, he might say beyond the possibility of doubt, a radical connection between the Mon or Talain people and the Sontals and similar tribes to the west of Bengal, whom he had designated as Kolarians. He had recently published a short comparative list of aboriginal words, and Mr. Man had appended to his Sontalia and the Sontals the same model list of test words which had been translated by Mr. Haswell. On comparing these lists, the first four numerals and the first four simple nouns (put first as of the most radical test character) were found to be in fact plainly identical; the only difference, where there is a difference, being of a uniform character, viz. that the shorter vowels of the Sontal words are changed into a broader *o*, *oo*, *oa*, or *au*, thus—

|       | <i>Sontali.</i> | <i>Mon.</i> |
|-------|-----------------|-------------|
| • One | mi or mia       | mooā        |
| Two   | barea           | bā          |
| Three | pea or pia      | pee or pi   |
| Four  | ponea           | paun        |
| Hand  | ti or tilhi     | toa         |
| Foot  | jang            | chang       |

|                               | <i>Sontali.</i> | <i>Mon.</i> |
|-------------------------------|-----------------|-------------|
| Nose                          | mu              | moo         |
| Eye                           | me or met       | mote        |
| The next higher numerals are. |                 |             |
| Five                          | monayia         | m'some      |
| Six                           | turui           | trou        |

Five might be doubtful ; the sixth seemed to be identical. Above six, the higher numerals seem to be all different. So, going on with the list of nouns, although a resemblance might be traced here and there, it was not easily seen ; and in fact most of the higher class words were different. He found a resemblance in the pronouns thus—

|       |      |      |
|-------|------|------|
| I     | aing | oa   |
| Thou. | amg  | m'na |
| He    | uni  | nya  |

Indeed Mr. Logan in his valuable paper had already recognised a connection in the form of the pronouns.

At first sight it appeared as if the Mon had lost the refined grammatical forms of the Sontals, and had lapsed into a Chinese-like simplicity of grammar, but the whole subject required much study. He found that Col. Dalton also held the opinion that some of the darker tribes of the extreme East of India have probably an affinity to the aboriginal races of Central India. Altogether the study of the eastern tribes, and their connection with those of the West and again with those still farther to the south-east, seemed to open up an almost boundless field of most interesting inquiry.

A letter from Professor Piazzzi Smyth, Astronomer Royal of Scotland, was read—

“ Herewith I have the pleasure of enclosing you a letter from Sir Walter Elliot, transmitted to me by my friend Colonel Walter Birch, 104th Fusiliers, and requesting your kind assistance in procuring for me a small block of stone, about the size of an ordinary British brick, or an octavo book,\* of particular quality, and transmitting the same, if procurable, to Colonel Birch's agents in Calcutta, Messrs.

\* In a letter of later date, Professor Piazzzi Smyth expresses a desire to obtain a block 6 or 7 inches square and 3 or 4 inches thick, without flaw.—*Ed.*

Grindlay & Co., whom the Colonel kindly promises to advise of its expected arrival and have it sent to me here.

“The reason for going so far, for so small a matter is,—that the stones of this country are too soft, or too large-grained, or too fissured, or too permeable by water : and I hope, from what I have heard of some Indian minerals, to get something supereminent in hardness, fineness of grain, toughness, freedom from fissures and crystallization, and proof against the entrance of water.

“*Corundum* has been mentioned ; but that will not do, for though hard enough, it is crystallized, and a lump would probably be only a brittle congeries of small crystals.

“*Basalt* has been mentioned, and if India has basalts like *some* of those in Upper Egypt, viz. excessively fine-grained, tough, compact, and free from fissures and tendency to fissure, over lengths of 8 and 9 inches,—it might do well. The basalts of Scotland are far too coarse-grained and full of fissures.

“A *pudding stone* from Agra that I have seen, contains particles of *jasper*, which promise to be better still, if the original rock of it, the jasper, could be got at. Its colours are red, brown and black, the grain almost infinitely fine, the hardness far above steel ; being too, I presume, a sedimentary, argillaceous rock, altered by plutonic heat, I should expect more toughness, freedom from fissures, and more uniformity than in basalt.

“If too, you can get one example, which will stand all these tests,—I should much like to hear whether more examples perfectly similar could be afterwards procured, and at what price. The purpose is, to form small standard scales of 5 to 10 inches in length, and likely to last unaltered in length and quality for a much longer time than the metals hitherto used for that purpose. Something capable of going down to all posterity, without sensible change, during 5,000 or 10,000 years.”

In commenting on the above, the Secretary said he had brought the note before the meeting with a view of soliciting the aid of Members through the medium of the published Proceedings. He would especially note, as promising stones, the jasper of the Sone and Nerbudda valleys, and the Jade, large lumps of which are sometimes to be obtained in the bazaars.

The receipt of the following communications was announced—

1. From Dr. A. Bastian of Bremen, a translation of an inscription copied in the temple of Nakhon Vat, in the city of Monasteries, near the capital of ancient Kambodia.

2. From Bahoo Gopee Nath Sen, Abstract of the hourly meteorological observations made at the Surveyor General's Office in October, 1866.

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The following additions to the Library since the Meeting held in January, 1867, were announced.

*Presentations.*

\*\*\* *The names of Donors in Capitals.*

Annales Musæi Botanici Lugduno-Batavi by F. A. G. Miquel, Vol. II, Fasc. III, IV and V.—THE BATAVIAN SOCIETY.

Cours d' Hindustani. Discours d'Ouverture du 3 Décembre, 1866, par M. G. de Tassy.—THE AUTHOR.

Many and great Dangers with Safeguards. Twelve Sermons by G. U. Pope, D. D.—THE AUTHOR.

Tamil Poetical Anthology. by G. U. Pope, D. D.—THE AUTHOR.

Tamil Prose Reading-book, by G. U. Pope, D. D.—THE AUTHOR.

Tamil Grammar, by G. U. Pope, D. D.—THE AUTHOR.

Lord's Sermon on the Mount in English, Tamil, Malayalam, Kanarese and Telugu, by G. U. Pope, D. D.—THE AUTHOR.

Report on the Police of the Town of Calcutta and its Suburbs for 1865-66.—THE BENGAL GOVERNMENT.

Report on the Survey operations for Season 1865-66.—THE SUPER-INTENDENT OF THE REVENUE SURVEY.

Almanach der Kaiserlichen Akademie der Wissenschaften. Sechszehnter Jahrgang, 1866.—THE ACADEMY.

Proceedings of the Royal Geographical Society of London, Vol. X. No. VI.—THE SOCIETY.

Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften; Philosophisch-Historische Classe; Band 51, Hefte 2, 3; Band 52, Hefte 1, 2, 4: Mathematisch-Naturwissenschaftliche Classe, Jahrgang 1865, 1ste Abtheilung, Nos. 8, 9-10. 2te Abtheilung, Nos. 9, 10. Jahrgang 1866, 1ste Abtheilung, Nos. 1, 2, 3, 4, 5. 2te Abtheilung, Nos. 1, 2, 3, 4, 5.—THE ACADEMY.

Denkschriften der Kaiserlichen Akademie der Wissenschaften : Mathematisch-Naturwissenschaftliche Classe. Band XXV.—THE ACADEMY.

Archiv für Kunde Oesterreichischer Geschichts-Quellen. Band XXXV. Heft 1, and Band XXXVI, Heft 1.

Register zu den Bänden I—XXXIII. des Archivs, and zu den Bänden I—IX. Notizenblattes :—THE ACADEMY.

Fontes Rerum Austriacarum. Band VII. Abtheilung I.—THE ACADEMY.

Register zu den Bänden I—XIV. der Denkschriften der Philosophisch-Historischen Classe der K. A. der W. Band I—THE ACADEMY.

• Chárûpât, Part I. of Akhaya Coomar, translated into Hindustani ?—THE TRANSLATORS.

#### *Exchanges.*

London, Edinburgh and Dublin Philosophical Magazine and Journal of Science, Vol. XXXII. No. 218.

The Athenæum for November 1866.

#### *Purchases.*

Dictionnaire Turc-Arabe-Persan by Dr. J. T. Zenker, Heft 10.

Deutsches Wörterbuch by J. and W. Grimm, Part IV. Fasc. 11 and Part V. Fas. I.

Comptes Rendus de L'Académie des Sciences, Nos. 22 and 23, 1866.

Journal des Savants, November 1866.

Revue et Magasin de Zoologie, No. 11 of 1866.

Revue des Deux Mondes, 1st December, 1866.

The Annals and Magazine of Natural History, No. 108, Vol. XVIII.

Reeve's Conchologia, parts 260 and 261 (Tellina and Unio).

The American Journal of Science and Arts, Vol. XLII. No. 126.

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PROCEEDINGS  
OF THE  
ASIATIC SOCIETY OF BENGAL,  
FOR MARCH, 1867.

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The Monthly General Meeting of the Asiatic Society of Bengal was held on Wednesday the 6th of March, 1867 at 9 P. M.

• Dr. J. Fayrer, President, in the chair.

The minutes of the last meeting were read and confirmed.

The following presentation was announced.

From the Editor, the "Pandit," a Monthly Journal of the Benares College, devoted to Sanscrit literature, No. 10.

The Council reported that they had elected Baboo Debendra Mullick a member of their body, in place of Dr. D. Boyes Smith, who had resigned.

The following gentlemen, proposed as ordinary members at the last meeting, were balloted for and elected.

The Hon'ble W. Markby.

Baboo Peary Mohun Mookerjee, M. A.

Captain H. W. King.

F. Hill, Esq.,

Baboo Jogindra Mullick.

W. G. Willson, Esq., B. A.

G. E. Knox, Esq., B. C. S.

Captain S. G. Montgomery, whose withdrawal was announced in July 1865, (owing to a mistake of his Agent,) was reinstated in the list of Members.

• The following gentlemen were named as candidates for ballot at the next meeting.

Lieutenant-Colonel B. Ford, Superintendent of Port Blair; proposed by Mr. H. F. Blanford, seconded by Mr. Grote.

Major G. Mainwaring; proposed by Mr. Grote, seconded by Mr. Blanford.

Dr. Mohindra Lal Sircar ; proposed by Baboo Rajendra Lala Mitra, seconded by Mr. Blanford.

The Hon'ble Nawab Sir Sherif-ul omrah Bahadoor, K. C. S. I. Member of the Legislative Council of Madras ; proposed by Moulavi Abdool Luteef Khan Bahadoor, seconded by Dr. Fayerer.

The receipt of the following communications was announced—

1. From D. Waldie, Esq., Experimental Investigations connected with the water supply to Calcutta, Part III.

2. From Dr. C. Macnamara, through Dr. Fayerer, on the intimate structure of muscular fibre.

3. From W. Scott, Esq., On the reproductive Functional Relations of several species and Varieties of *Verbascums*.

4. From Baboo Gopee Nath Sen, Abstract of the Hourly Meteorological Observations made at the Surveyor General's Office in November, 1866.

At the request of the President, Dr. Macnamara read his paper "On the intimate structure of muscular fibre," of which the following is an abstract.

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"The muscular system, whether voluntary or involuntary, is composed of an homogeneous substance, the characteristic features of which are, that it contracts in obedience to the nervous force, direct, or reflex. The elements of the contractile tissue, under all circumstances, are arranged so as best to fulfil the mechanical purposes for which it is intended.

"In voluntary muscles there are no such elements as have been described as sarcoous particles, but the contractile tissue consists of bundles of contractile fibres, each fibre being composed of two longitudinal bands running continuously from one end of the muscle to the other end, and connected throughout their length by spiral transverse bands, the whole being encased in a sheath of homogeneous tissue. A voluntary muscle therefore consists of a matrix of fibrous tissue, the interstices of which are filled up with contractile fibres such as I have just described ; the larger vessels and veins ramifying in the fibrous matrix, but giving off numerous branches which are brought into immediate contact with the contractile tissue.

"It is evident that bands of elastic tissue could not perform the functions required of a muscle : the increase in breadth of the muscles



of a limb in contracting would, under these circumstances, exercise an injurious amount of pressure on the nerves and vessels of surrounding parts. All such anomalies are obviated by the arrangement I have now described; for in contracting, the longitudinal bands must shorten on themselves, drawing the transverse bands into closer approximation, and these at the same time uncoil: each fibre therefore increases in breadth exactly to the same amount which it loses in length, the changes, as in a muscle, being accurately proportioned to one another. It is quite possible that as the longitudinal bands are attached to fixed points at either extremity, the tension or relaxation of the transverse bands would be sufficient of themselves, by acting on the longitudinal bands, to cause contraction or relaxation of the muscle; and I am disposed to favour this idea, because we can thus easily conceive the means by which the remarkably rapid action which muscles are capable of effecting is accomplished; being kept in a state of perpetual tension depending on the action of the spiral bands.

“If this be the minute anatomy of muscle, it displays a source from whence animal heat may be derived. Much of Liebig's theory of the combustion of the hydro-carbons being the chief if not only source of animal heat, is falling to the ground; but in muscle or bone, there is evidence of the existence of forces as capable of engendering heat as combustion, viz. friction, compression, tension and expansion, all necessarily giving rise to molecular motion, and an equivalent amount of heat, quite capable of keeping up the temperature of the blood to a healthy standard.

“It appears also that we may equally well explain the presence of electricity in a muscle, by the play of the forces above enumerated: they must, in fact, when set in motion, induce electrical phenomena, and that independently of the nervous system.”

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A discussion ensued on the subject of the above paper; after which, on the proposition of the Secretary, the special thanks of the meeting were unanimously voted to Dr. Macnamara for the important communication just read to the meeting.

The following are the additions made to the Library since the meeting held in February last.

## Presentations.

\*.\* The names of Donors in Capitals.

Rahasya Sandarbha, Vol. III, Nos. 35 and 37.—THE CALCUTTA SCHOOL BOOK SOCIETY.

The Report of the British Association, Bath, 1864.—THE ASSOCIATION.

Sonthalia and the Sonthals.—THE GOVERNMENT OF BENGAL.

Selections from the Records of the Government of India, Foreign Department, No. 51, (Political Administration of Central India for 1865-66.)—THE GOVERNMENT OF INDIA.

Another Copy.—THE GOVERNMENT OF BENGAL.

A list of Waste Land Sales made in Cachar under the new Waste Land Rules, with a map.—THE GOVERNMENT OF BENGAL.

Report of the Committee of the Bengal Chamber of Commerce from May to October, 1866.—THE CHAMBER OF COMMERCE.

Proceedings of the Royal Society of London, Vol. XV, No. 87.—THE SOCIETY.

Zeitschrift der Deutschen Morgenländischen Gesellschaft, Zwanzigster Band, Heft IV.—THE EDITOR.

Descriptive Catalogue of Vernacular Books and pamphlets forwarded by the Government of India to the Paris Exhibition of 1867, by the Rev. J. Long.—THE AUTHOR.

Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften zu Wien,

*Philos-histor. Classe;*

{ Band 49, Hefte I, II, III,  
Band 50, Hefte I, II, III, IV,  
Band 51, Heft I, and  
Register zu den Banden 41  
bis 50.

1ste Abth.  
*Math-Naturw. Classe.*

2te Abth.

{ Band 51, Hefte III, IV, V,  
Band 52, Hefte I, II, &  
Band 51, Hefte III, IV, V,  
Band 52, Hefte I, II, III,

and Register zu den Bänden 43 bis 50.—DIE AKADEMIE DER WISSENSCHAFTEN ZU WIEN.

Denkschriften der Kaiserl. Akademie der Wissenschaften; *Philos. histor. Classe*, Band XIV., *Math. Naturw. Classe*, Band XXIV.—THE ACADEMY.

Archiv für Oesterreichische Geschichte—

Band XXXIII. Hefte 1, 2

XXXIV. Hefte 1, 2

• XXXV. Hefte 1.—THE ACADEMY.

Fontes Rerum Austriacarum, II Abth. Band XXIV.—THE ACADEMY.

Atlas der Hautkrankheiten, Lief. V —THE ACADEMY OF SCIENCES OF VIENNA.

Almanach der Kaiserlichen Akademie der Wissenschaften für 1865.—THE ACADEMY.

Verhandlungen der K. K. Zoologisch-botanischen Gesellschaft in Wien, Band XV.—THE EDITOR.

Philosophical Transactions of the Royal Society of London, Vol. 155, pt II, Vol. 156, part I.—THE ROYAL SOCIETY.

Researches on Solar Physics by W. de la Rue, B. Stewart and B. Loewy, First Series.—THE AUTHORS.

Results of Meteorological and Magnetical Observations made at the Stonyhurst College Observatory.—THE COLLEGE.

Report on the Result of the Administration of the Salt Department, during the year 1865-66.—THE GOVERNMENT OF BENGAL.

Der Meteorsteinfall am 9 June, 1866, bei Knyahinya (Zweiter Bericht), von W. Ritter v. Haidinger.—THE AUTHOR.

Results of twenty-five years' Meteorological observations for Hobart Town, by F. Abbott F. R. A. S.—THE ROYAL SOCIETY OF TASMANIA.

Abhandlungen für die Kunde des Morgenlandes. Band IV. No. 5.—THE SOCIETY.

Proceedings of the Royal Society of London, Vol. XV. No. 88.—THE ROYAL SOCIETY.

Transactions of the Royal Society of Edinburgh, Vol. XXIV. Part II.—THE ROYAL SOCIETY OF EDINBURGH.

Journal of the Statistical Society of London, Vol. XXIX. Part IV.—THE STATISTICAL SOCIETY.

Proceedings of the Royal Society of Edinburgh, Vol. V. No. 68.—THE ROYAL SOCIETY OF EDINBURGH.

Report on the Operations of the Thuggee and Dacoity Department in Native States, by Lieutenant-Colonel C. Hervey, C. B.—THE FOREIGN DEPARTMENT TO THE GOVERNMENT OF INDIA.

A Narrative of the Russian Military Expedition to Khiva under

General Perofski in 1839.—THE FOREIGN DEPARTMENT TO THE GOVERNMENT OF INDIA.

The Pandit, a monthly Journal of the Benares College devoted to Sanskrit Literature, No. 10, Vol. I.—THE EDITOR.

*Purchased.*

Râs Malâ or Hindoo Annals of the Province of Goozerat, by A. K. Forbes, 2 Vols.

Ure's Dictionary of Arts, Manufactures and Mines ; by R. Hunt, F. R. S., F. G. S., 3 Vols.

Catalogue of Colubrine Snakes in the Collection of the British Museum, by Dr. A. Günther.

History of the British Empire in India from 1844 to 1862, by L. J. Trotter, 2 Vols.

History of Herodotus translated into English, with copious notes, by G. Rawlinson, M. A., 4 Vols.

Comparative Anatomy and Physiology of Vertebrates, by R. Owen, F. R. S., 2 Vols.

A Dictionary of Science, Literature and Art ; by W. S. Brande, D. C. L., F. R. S. L. and the Rev. G. W. Cox, M. A., 2 Vols.

The Chinese Classics by J. Legge, D. D., Vols. I. and II. and 2 Parts of Vol. III.

Ballhorn's Grammatography.

Travels in Central Asia, by A. Vâmbéry.

A History of Persia from the beginning of the nineteenth century to the year 1858 ; by R. G. Watson.

The Record of Zoological Literature ; by A. C. L. G. Günther, M. A., M. D., Ph. F. D. R. S., Vol. I.

Icones Zootomicæ mit Originalbeiträgen ; by J. V. Carus. Erste Hälfte oder Tafel I.—XXIII.

The Oriental Races and Tribes, Residents and Visitors of Bombay, 2 Vols. ; by W. Johnson.

The Quarterly Journal of Science, Nos. I. to XI.

Introduction to the study of the Foraminifera ; by W. B. Carpenter, M. D., F. R. S.

La Maha-Bharata by H. Fanche, Vol. VI.

Comptes Rendus de l'Académie des Sciences. Tome LXVII. Nos. 24 and 25.

Revue des Deux Mondes, 15th December, 1866.

The Calcutta Review, No. LXXXVIII. February, 1867. •

Histoire Naturelle des Annelides marins et d'eau douce, by M. A. De Quatrefages, Tomes I, II, Parts 1 and 2, with plates.

Catalogue of the Acanthopterygian Fishes in the collection of the British Museum; by Dr. A. Gunther, 2 Vols.

The Architecture of Dharwar and Mysore, by Col. M. Taylor.

The Architecture of Beejapoor, by Col. M. Taylor.

The Kamil of El-Mubarrad: by W. Wright, Part III.

Jacdut's Geographisches Worterbuch: Erste and Zweite Hälfte. Bog 61-118.

• Revue des Deux Mondes, 1st January, 1867.

The Numismatic Chronicle and Journal of the Numismatic Society, 1866, Part IV.

The Quarterly Journal of Science, No. XIII.

The Journal of Sacred Literature and Biblical record, No. XX. N. S.

Comptes Rendus des Séances de l'Académie des Sciences, Nos. 26 and 27, 1866. •

Tables des Comptes Rendus, Premier Semestre, 1866.

Journal des Savants, December, 1866.

The Westminster Review, No. LXI. January, 1867.

The Annals and Magazine of Natural History No. CIX. January 1867.

*Exchange.* •

The Athenæum, December, 1866.





PROCEEDINGS  
OF THE  
ASIATIC SOCIETY OF BENGAL,

FOR APRIL, 1867.



A meeting of the Asiatic Society of Bengal was held on Wednesday the 3rd April, at 9 P. M.

Dr. J. Fayrer, President, in the chair.

The minutes of the last meeting were read and confirmed.

Presentations were announced :—

1. From A. Grote, Esq a specimen of *Tragulus Javanicus*.
2. From Dr. J. E. T. Aitchison, a specimen of *Larus Ichthyactus*, a Sea Gull, shot at Umritsar in the Punjab in May last.
3. From Lieutenant J. Waterhouse, a box of specimens of plum-bago from the Sonah mines near Delhi.
4. From Baboo Gour Doss Bysack, a few bricks and a carved Koran stand from the Sat-Gombouj of Bagharhant. ●
5. From the Rev. C. H. Dall, 3 photographs of the hairy family at Ava.

6. From Captain J. Anderson, a fragment of stone from the old tomb of Mrs. Mary Hastings at Berhampore with a copy of the epitaph. ●

7. Mr. Blanford exhibited, on part of Mr. Grote, a few specimens of a curious sponge ("Ragaderos") from the Philippine islands.

8 The Council reported that they have elected H. Blochmann, Esq. ● a member of the Library Committee.

9. The following gentlemen, proposed at the last meeting, were balloted for and elected as ordinary members :—Major G. Mainwaring ; Lieutenant-Colonel B. Ford ; the Hon'ble Nawab Sir Sherif ul O'airah Bahadur, K. C. S. I. ; Dr. Mohindra Lala Sirkar.

10. The following gentlemen are candidates for ballot as ordinary members at the next meeting :—

Lieutenant E. J. Steel, R. A. of the Revenue Survey, Debroogur, Assam, proposed by Captain H. H. G. Austen, and seconded by Mr. H. F. Blanford.

The Hon'ble F. Glover, proposed by Mr. E. C. Bayley, and seconded by Mr. H. F. Blanford.

Dr. B. N. Hyatt, Civil Surgeon, Ranchee, proposed by Lieutenant-Colonel E. T. Dalton, and seconded by Dr. J. Anderson.

Dr. E. Bonavia, Assistant Surgeon, Lucknow, proposed by Dr. J. Anderson, and seconded by Mr. H. F. Blanford.

Dr. S. C. Mackenzie, proposed by Dr. Ewart, seconded by Dr. Colles.

J. A. B. Nelson, Esq. proposed by Mr. A. Grote, and seconded by Mr. H. F. Blanford.

11. Letters were read from E. W. Clementson, Esq. and Captain W. G. Murray, intimating their desire to withdraw from the Society.

12. The receipt of the following communications was announced :—

1. From Babu Gopee Nath Sen, Abstract of Hourly Meteorological observations made at the Surveyor General's Office in December last.

2. From Captain H. H. Godwin Austen, F. R. G. S. Notes on the geological features of the country over the foot of the hills in the Western Bhotan Dooars.

3. From Dr. E. Bonavia, Affinity between the adjutant and the domestic turkey.

4. From Babu Gour Doss Bysack, "Antiquities of Bagharhaut."

13. At the request of the President, Mr. D. Waldie read the following abstract of his experimental investigations connected with the water supply to Calcutta, Part III.

"The object of this communication is to correct a few errors and deficiencies in the former papers, and supply additional information, so as to render the inquiry more complete. It will also direct attention to some points of importance calling for special consideration.

"The general constitution of the Hooghly water, as regards its mineral constituents, is exhibited by two tables, one giving the proportions of these in a way favourable for comparing its variations at different seasons, and another shewing its hardness. Though the water is rather hard during the dry season, the hardness is reduced to a very



small amount by boiling. It is superior in this respect to what can usually be obtained for the supply of towns. The influence of the tides during the hot season was considered in the first communication : the tidal water increases the amount of common salt, but does not very greatly increase the hardness.

“As regards organic matter, numerous observations have been made since the last communication was laid before the Society, partly to meet objections raised against the former results, which objections however may now be considered as withdrawn.

“Further examination of the various waters by oxidation by permanganate of potash has not increased the author's opinion of its value, and two tables are given which it is believed will justify this unfavourable opinion. The first exhibited the very rapid change which takes place in the deoxidating power of many waters both river and tank, this power diminishing within two days to one half, one third, or even less, of its original amount. This is not noticed in the London Reports, probably because the samples having been taken from the street mains, the water is at least two or three days old, after which it changes much more slowly. The oxidation test appears to indicate only certain kinds of impurities,—probably products of fermentation or putrefaction, or even of living vegetable organisms, and it is doubtful if it gives much important information of the quality of these, as the second table shews that General's Tank water (considered the best for drinking in Calcutta) equals in deoxidating power the water of the salt marsh to the east of the town ; and that the water of the Circular canal, which receives the greater part of the sewerage of Calcutta, requires no more oxygen than that of the best tanks.

“The determination of organic matter by weight is the most trustworthy. Care has been taken in all the recent analyses to proceed to the evaporation without delay, but continued observation has also shewn that the results formerly given cannot have been far wrong. The quantity of organic matter in the river water for the months of January and November has in no case exceeded 15 grains per 100,000 grains, or 1.05 grains per gallon. A table is given of the results at all seasons, which distinctly shews the influence of the tides, the quantity of organic matter during flood tide being from one and half to two and half times greater than during ebb tide. Yet the highest

obtained was 2.7 grains per 100,000 grains, or rather less than 2 grains per gallon.

“ Another table exhibits the amount of organic matter in the water of the Salt Water Lake and Circular canal. On the 18th February the water of the marsh contained only 6.5 grains per 100,000 grains or 4.55 grains per gallon. A calculation made on data supplied by Mr. Leonard (reduced to one half on account of uncertainty) or 5000 ft. per second of water flowing in the river at the minimum, shew that though Mr. Clark's supply of 6,000,000 gallons of water per day flowed into the river in as concentrated a state of impurity as the filthiest ditches of Calcutta during the hot season, it would add of organic matter to the river water only to the extent of 5 or 6 hundredths of a grain per gallon. The allowance is extravagant, yet the addition is but small.

“ Trials for Ammonia, exhibited in tables, shew that the water during the cold season is at its purest, and other observations on the organic matter are confirmatory of those previously made.

“ Further observations on the tank waters confirm the conclusions formerly drawn. Additional samples have been examined in the northern part of the town, with reference to a tank proposed to be excavated there by the Municipality. All the tank waters examined, except those of the Maidan tanks and Dalhousie Square Tank, contained much more saline matter and were much harder both before and after boiling than the river water at its worst (except as regards salt during flood tide in May and June,) and contained much more organic matter,—two, three, or four times as much. The water of the street aqueduct (from the river) was greatly superior in every respect. Water obtained from temporary wells dug for the purpose was carefully analysed and found to be simply sewage water, deprived of the greater part of its bad smell by passing through the earth; indicating that the soil is more or less penetrated by sewage water all over the town.

“ Further consideration had been given to the nature of the organic matter, confirmatory of former observations. The organic matter in the river water during the rainy season was analagous to that of tank water, and contained a larger proportion of vegetable matter than that of the dry season. But it by no means followed that it was less

objectionable. When partially separated from saline matter, its general properties more resembled those of animal excrementitious matter, while those of the dry season water more resembled urinous sécrétions. The rainy season water also seemed to contain much more living germs.

"As to the question of taking water from Cossipore, it may be said that it would scarcely be advisable to do so, as there can be no doubt of the influence of the tide rendering the water impure: whether a point nearer than Pultah would be suitable, could only be determined by observations during the hot season. But there is a point of greater importance to consider, namely the state of the river water during the rains, especially during the early part of the season. The water then contained the sewerage of thousands of square miles of country, and was much more putrid and offensive than even the flood tide water of the hot season; and besides contained a large quantity of mud in a very fine state of division, very difficult to get rid of either by subsidence or filtration; and this water cannot be avoided by taking it from Pultah. The greater impurity of river waters during floods is a fact well recognized in England, and here we have all the floods of the year concentrated into one great flood. The Engineer to the Municipality had taken into account the unusual quantity of mud in the water at this season, and had made arrangements intended to obviate the difficulty: but there is great reason to fear that these measures will be very inadequate for the purpose, and that the large covered reservoirs will, during the early months of the rains, supply water of a very offensive character, and perhaps taint it for a considerable time afterwards. There is no evidence in the Engineer's Report that the extent of the difficulty has been appreciated or even properly understood, or that the efficiency of the means to remedy it has been satisfactorily ascertained."

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LIBRARY.

The following additions were made to the Library since the meeting held in March:—

\*\*\* *The names of Donors in Capitals.*

*Presentations.*

Jahrbuch der Kaiserlich Königlichen Geologischen Reichsanstalt.  
—Vol. XV, XVI.—THE K. K. GEOL. REICHSANSTALT.

The History of India in Urdu, No. 9.—THE SCIENTIFIC SOCIETY OF ALLYPURH.

Professional papers on Indian Engineering, No. 14, Vol. IV.—THE EDITOR.

Annual Report of the Trustees of the Museum of Comparative Zoology at Harvard College 1865.—THE TRUSTEES OF THE MUSEUM.

Report of the Superintendent of the Coast Survey of the U. S. 1859 and 1860.—THE UNITED STATES OF AMERICA.

Proceedings of the Boston Society of Natural History for 1864.—THE BOSTON NATURAL HISTORY SOCIETY.

Conditions and Doings of the Boston N. H. Society for 1864.—THE BOSTON NATURAL HISTORY SOCIETY.

Documents of the United States Sanitary Commission, 3 Vols.—THE U. S. SANITARY COMMISSION.

Annual Report of the Board of Regents of the Smithsonian Institution for 1864.—THE INSTITUTION.

Memoirs of the Geological Survey of India, Vol. V. pt. 3.—THE GOVT. OF BENGAL.

Catalogue of the Organic Remains belonging to the Cephalopoda in the Museum, Geological Survey of India, Calcutta.—THE GOVT. OF BENGAL.

Catalogue of the Meteorites in the Museum, Geological Survey of India, Calcutta.—THE GOVT. OF BENGAL.

A Narrative of the Russian Military Expedition to Khiva under General Perofski in 1839.—THE GOVT. OF BENGAL.

Notes on the Geographical, Statistical and General condition of Purgunna Palamow, by Major G. H. Thompson.—THE GOVT. OF BENGAL.

Report on the Registration of Ozone in the Bombay Presidency for 1864-65.—THE GOVT. OF BENGAL.

Ueber ein Fragment der Bhagavati, 1st part, by Prof. A. Weber.—THE AUTHOR.

Selections from the Records of the Bombay Government, No. CI. New Series (Extract of the Proceedings of the International Sanitary Conference of 1866.)—THE GOVT. OF BOMBAY.

Annual Report of the Administration of the Madras Presidency for 1865-66.—THE GOVT. OF BENGAL.

General Report on the Administration of the Bombay Presidency for 1865-66.—THE GOVT. OF BENGAL.

Report on the Administration of the N. W. Provinces for 1865-66.  
—THE GOVT. OF BENGAL.

Annual Report on the Operations of the Post Office of India for 1865-66.—THE GOVT. OF BENGAL.

Report on the Administration of the Central Provinces for 1865-66.  
—THE GOVT. OF BENGAL.

Annual Report of the Administration of Coorg for 1865-66.—THE GOVT. OF BENGAL.

General Report on the Administration of the Punjab Territories for 1865-66.—THE GOVT. OF BENGAL.

Annual Report on the Administration of Mysore for 1865-66.—THE GOVT. OF BENGAL.

Report on the Administration of the Penal Settlement of Port Blair and Andaman Islands for 1865-66.—THE GOVT. OF BENGAL.

Annual Report on the Administration of the Straits Settlement for 1865-66.—THE GOVT. OF BENGAL.

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PROCEEDINGS  
OF THE  
ASIATIC SOCIETY OF BENGAL,  
FOR JUNE, 1867.



The Monthly General Meeting of the Asiatic Society of Bengal was held on Wednesday, the 5th instant, at 9 P. M.

Dr. J. Ewart, in the chair.

The minutes of the last meeting were read and confirmed.

Presentations were announced—

1. From the Editor, the first Volume of the “Pandit.”
2. From the Königlich Preussischen Akademie der Wissenschaften, I. Abhandlungen, 1865.
3. From the Government of Bombay, through Dr. R. L. Playfair, a copy of the “Fishes of Zanzibar.”
4. From Lieutenant-Colonel B. Ford, Superintendent, Port Blair, specimens of a *Fulgoria candelaria* and a *Phyllium Siccifolia*, and the Skull of a Dugong.

5. The following gentlemen, proposed and duly seconded at the last meeting, were balloted for and elected as ordinary members.

The Right Rev. Dr. Milnan, Lord Bishop of Calcutta,

Lieutenant J. Gregory.

W. Duthoits, Esq., C. S.

J. M. Scott, Esq., C. E.

• Bábu Obhoy Churn Mullick.

6. The following gentlemen were candidates for election at the July meeting.

C. A. Hackett, Esq., A. R. S. M., Geological Survey of India, proposed by Mr. Ball, and seconded by Mr. Ormsby.

Dr. C. Macnamara, proposed by the President, and seconded by Mr. Ormsby.

N. A. Belletty, Esq., Civil Assistant, Topographical Survey of India, proposed by Captain H. H. G. Austen, and seconded by Mr. Grote.

Dr. J. J. Wood, officiating Garrison Assistant Surgeon, Fort William, proposed by Dr. Ewart, and seconded by Dr. Partridge.

The Council reported that they have elected the following gentlemen to fill up vacancies in the several Committees.

*In the Library Committee*,—H. B. Medlicott, Esq., and Cumár Harendra Krishna Deva.

*In the Natural History Committee*,—H. B. Medlicott, Esq., V. Ball, Esq., Dr. J. Ewart, and, Mr. Justice Norman.

*In the Statistical Committee*,—Mr. Justice Phear.

*In the Linguistic Section of the Ethnological Committee*,—Mr. Justice Markby.

A letter was read from Lieutenant-Colonel H. Raban, intimating his desire to withdraw his name from the Society.

Letters were read—

7. From the Director of Public Instruction, forwarding a copy of Mr. Cowell's Report on the Toles of Nuddea.

No. 1547.

*From the Director of Public Instruction,  
To the Secretary of the Asiatic Society.*

*Dated Fort William, 9th April, 1867.*

SIR,—I have the honor to forward herewith, for the information of the Asiatic Society, a copy of a report on the Sanskrit Toles of Nuddea by Mr. E. B. Cowell, late Principal of the Sanskrit College.

I have the honor to be,

Sir,

Your most obedient Servant,

W. S. ATKINSON,

*Director of Public Instruction.*

*From E. B. COWELL, Esq., late Principal, Sanskrit College, Calcutta,  
to W. S. ATKINSON, Esq., Director of Public Instruction;—(dated  
the 19th January, 1867.)*

SIR,—I have the honor to forward you my Nuddea Report. As I have added at the end some remarks on its necessary defects and the causes of my long delay in sending it, I need not repeat them here.

I may add that the report would have been finished before I left India, if my time had not been occupied by some communications about the Madrassah, which took off my thoughts from the report.

I hope the report will be of some use, as it is. I wish I could return for a month to Nuddea, to make it better.

From E. B. COWELL, Esq., late Principal of the Sanskrit College, to W. S. ATKINSON, Esq., Director of Public Instruction,—dated the 17th January, 1867.

SIR,—I have the honor to forward to you the following report of my visit, in 1864, to the Toles of Nuddea :—

In accordance with your instructions I proceeded thither with Mr. Woodrow, and we were accompanied by Pandit Mahesa Chandra Nyáyaratna, one of the Professors of the Sanskrit College, with whom I have for some years studied Nyáya, and to whose wide attainments in Hindu philosophy, as well as general ability and learning, I can testify from personal knowledge in the highest degree. We left Calcutta on Monday the 29th of February, and made Krishnagur our head quarters, whence we made daily excursions to Nuddea, which is about ten miles distant. I must not omit to mention that we received much attention from the Mahárájá of Nuddea, who held a *quasi* durbar of Pandits, which enabled us to make the acquaintance of many who did not reside in Nuddea itself. I returned to Calcutta on the 8th of March.

The word Tole (টোল) is a Bengali word of uncertain derivation ; but there are at least two Sanskrit words for the thing itself, *chatúsh-páthi*, i. e., a place where the four vedas are studied, and *maṭha*. The former does not seem to be an ancient word, as I do not find any authority for it in the St. Petersburg Sanskrit Dictionary, except the Sabda Kalpa Drúma of Rájáh Rádhá Kánta Deva ; but *maṭha* is an old word and occurs at least as far back as the Amara Kosha.

The institution is curious and interesting, as being undoubtedly a remnant of old times. It represents, in fact, the same state of feeling in ancient India as that which we find in ancient Greece, and which so continually comes up in Plato's controversies with the Sophists or paid Professors of his day, viz., the popular prejudice against receiving mercenary reward for the communication of knowledge. The Pandit of a tole should properly not only instruct his pupils gratuitously,

but he should also provide them with food, clothing and lodging, during their stay under his teaching. He himself is to be remunerated indirectly by the invitations and presents which celebrity as a teacher would ensure his receiving at the religious ceremonies of the neighbouring zemindars. Thus my own visit was delayed some weeks in consequence of all the principal Pandits of Nuddea being absent, as they had gone to attend the grāddha of the late Rājāh of Cooch Behar. The tole system of Nuddea has, however, degenerated in this as in other respects. The Pandits of most toles in other districts still lodge and feed their pupils; but those of Nuddea, with very few exceptions, have been able to break through this custom. They now only supply their pupils with lodging, the reputation of Nuddea no doubt enabling them to attract students from other toles in spite of the greater inducements which the latter offer.

The chief studies of Nuddea are Smṛiti and Nyāya. It is the latter, especially, for which its name is celebrated all over India. Other provinces have their own peculiar schools of law, and Nuddea, therefore, can generally only attract students of Bengal to its Smṛiti toles; but in logic it has an unrivalled reputation. Chaitanya, the celebrated reviver of the mystic worship of Kṛishṇa at the close of the 15th century, was a native of this place; and it has produced a succession of great Naiyāyika teachers, whose names are household words in every Pandit family in India. In fact the name of Nuddea is associated with the latest development of the Nyāya philosophy.

The ancient Sūtras or Aphorisms of Gotama do not represent the modern logic of India; and although the recent school may have added little or nothing to the real discoveries of the Hindu Aristotle, they have undoubtedly elaborated a most refined system of logomachy, far surpassing in subtilty and ingenuity all the scholastic disputations of mediæval Europe.

One of the most celebrated mediæval logicians was Gaṅgeṣa Upādhyāya of Mithilā, who wrote a large treatise, called the *Chintāmaṇi*, in four sections on the four Naiyāyika *pramāṇas* or sources of knowledge, i. e., perception, inference, comparison, and testimony. It is this work which has furnished the text to the modern Nuddea school. Its most renowned members are the following.

1. Raghunātha Ācārya, who wrote a commentary on the first two sections of the *Chintāmaṇi*. This is called the *Didhiti*.

2. Mathurá Nátha Tarkavágiça, who wrote a gloss on the *Didhiti* and also an original comment on *Gangeça*.

3. Jagadiça Tarkálankára, who also wrote a commentary on part of the *Didhiti* as well as many other works, especially a very celebrated treatise on logic and grammar, called the *çabda-çakti-prakáçiká*.

4. Gadádharma Bhattáchárya, who wrote a commentary on the *Didhiti* and a series of works, such as the *Vishayatá-vádártha*, &c., on the abstrusest mysteries of the modern logic.

5. Çankara Tarkavágiça, who wrote a commentary called *Patriká*, on the harder passages of Mathurá Nátha, Jagadiça, and Gadádharma. He seems to have flourished about sixty or seventy years ago: and it is he who is said to have brought to its height the present vicious system of disputatious logomachy which prevails in Nuddea.

A tole is generally a mere collection of mud hotels round a quadrangle, in which the students live in the most primitive manner possible. The Pandit does not reside with them, but comes to teach them on the lawful days. Each student has his own hut, with his brass waterpot and mat, and few have any other furniture. Most make their own copies of the books they use, and a large part of the year is vacation, during which they wander over the surrounding country on begging expeditions; but during the reading months much hard mental labour is undoubtedly gone through. On one side of the quadrangle there is a "lecture hall," usually on a raised platform, some three feet from the ground; it is open on one side, and just sheltered on the other three from the rain and wind. In some toles it is only a thatched shed; in others it is a little more elaborate. Only one tole in Nuddea can boast of any external adornment. This is the tole of Pandit Prasanna Chandra Tarkaratna. It was built for him by a Bábú of Lucknow, and is really an elegant building, occupying about a beegah and a half of land. The quadrangle inside is about thirty yards square and contains thirty rooms for the students. The rooms are generally about nine feet long and eight wide, with a window and door; the corner rooms are rather larger. More than half of one side is given up to a lecture hall or *dálán*. This stands on a platform raised some five feet from the ground; it has two apartments, each about thirty-three feet in length, the outer is ten, the inner twelve feet wide; and the front is supported by six pillars

which produce a very good effect. The other toles have no architectural display whatever. Everything is of a more than Spartan simplicity; and one cannot help honouring the zeal for knowledge, however misdirected the zeal or useless the knowledge, which leads so many students, generation after generation, to devote themselves to such monastic privations and hardships. The love of fame is, no doubt, the motive with many. The fact of having studied at Nabadwipa and gained an *upādhi* there, will ensure respect for a Pandit in every part of India, from Lahore to Travancore. But there are some who are led by less worldly motives. These come to study Nyāya, as students came to the University of Paris in the middle ages, and one can hardly fail to be reminded of Chaucer's lines about—

“The clerk of Oxenforde also  
That unto logik hadde long ygo;  
As lene was his horse as is a rake,  
And he was not right fat, I undertako.  
And able that he was a philosophre,  
Yet hadde he but litel gold in cofre.”

I could not help looking at those unpretending lecture halls with a deep interest, as I thought of the Pandits lecturing there to generation after generation of eager inquisitive minds. Seated on the floor with his ‘corona’ of listening pupils round him, the teacher expatiates on those refinements of infinitesimal logic which make a European's brain dizzy to think of, but whose labyrinth a trained Nuddea student will thread with unfaltering precision. I noticed during my visit middle-aged and even grayhaired men among the students of the celebrated toles, and some of these had come from such widely different homes as Lahore, Pooree, and the Tamil country.

I visited every tole in Nuddea, and examined every one with my Pandit more or less thoroughly. The following is a list; but the number of the students is probably not wholly accurate, as of course no register of attendance is kept, and it was not easy to decide whether absent students were really to be counted on the rolls or not. Professor Wilson found from 500 to 600 pupils at the time of his visit in 1829, the number is now less than 150. Part of the decrease may no doubt be attributed to the prevalence of the epidemic which has driven many away, and prevented others from

coming; but there are other and permanent causes at work for the overthrow of the scholastic glory of Nuddea.

● *Smṛiti.*

1. The tole of *Brajānāth Vidyāratna*. Here there were seventeen students, four from the districts round Nuddea (*deçiya*), and thirteen from other parts of Bengal (*bideçi*). Those from Bengal came from Dacca, Rungpore, Dinajpore, Jessore, Rajshahi, and Pubna.

2. That of *Rāmnāth Tarkasiddhānta*. Here there were ten *bideçi* and five *deçiya* students. The former came from Jessore, Khunla near Dacca, Dacca, Tripur, and Burisal.

3. That of *Madhusudan Nyāyaratna*, the brother of Hara Mohan Chudāmaṇi. Here there were three *deçiya* and seven *bideçi* students, the latter from Jessore and Burisal.

4. That of *Haridāsa Çiromaṇi*. Here there were four students, two from the neighbouring district and two from Dacca.

5. That of *Çib Nāth Bidyābāchaspati*. Here there were four students, two of whom came from Midnapore and one from Jessore; the fourth was a native of the Nuddea District.

6. That of *Prasanna Cūmār Vidyāratna*, brother of the deceased Çri Rām Tarkaratna. Here there were fourteen students, twelve of whom were *bideçi*, i. e., as coming from Burisal, Dacca, and Chittagong.\*

*Nyāya.*

1. That of the two brothers, *Hara Mohan Chudāmaṇi* and *Bhuvan-mohan Vidyāratna*, and their uncle, *Raghūmaṇi Vidyābhushan*. Here there were twenty-one students, four *deçiya* and seventeen *bideçi*,—the latter from Furreedpore, Burisal, Dacca, Midnapore, Jessore, Mithilā, and one even from Nepal.

2. That of *Prasanna Chandra Tarkaratna*. Here there were eighteen students, fourteen of whom were *bideçi*, i. e., six from Mithilā, five from Delhi and Lahore, two from Pooree and one from the Tamil country.

3. That of *Mādhava Chandra Tarkasiddhānta*. Here there were sixteen students, eight of whom were *bideçi*, i. e., four from Bakla near Comilla, two from Dinajpore, and two from Jessore.

\* His pupils were quite middle-aged and some greyheaded. They wished to read with him, though a young man of twenty-five, as he belonged to a family long renowned as Smārta Pandits.

4. That of *Hari Náth Tárkasiddhánta*. Here there were thirteen students, ten of whom were *bideśí*, i. e., five from Midnapore, four from Mithilá, and one from Nepal.

5. That of *Krishna Kánta Ġiroratna*. Here there were two students, both from Jessore.

6. That of *Brahmaçrama Swámi*, a dandi Goswami.

He had lately had seven students, but only one was with him at the time of my visit. His former house was destroyed by an inundation of the river. Before him it had been occupied by a very celebrated *dandi* named Swayam Prakāça; and tradition reports that it was at that house that the once projected College of Nuddea was to have been established.

Thus at the time of my visit I found only twelve toles. Professor Wilson in 1829 appears to have found twenty-five!

Besides these regular toles, there is also an udásin or ascetic recluse from Pooree, named Káçi Náth Ġástri, who teaches Vedánta to the students of other toles:—

The following are some of the celebrated pandits in Nuddea without toles.

1. Lál Mohan Vidyábhushan.
2. Nanda Kumár Vidyábhushan. These two are very learned in Smṛiti.

The following are profoundly versed in Nyáya:—

3. Umácharan Tarkaratna.
4. Rájnaráyana Nyáyabhushan.
5. Nilmani Sárvaabhauma.
6. Surya Kánta Vidyálankár.
7. Raghumañi Tarkapanchánan.
8. Umá Kánta Nyáyaratna.
9. Purushottam Nyáyaratna.

Of course there are also many toles in the villages round Nuddea, these I did not visit; but I particularly heard of that of Lakshmi Kánta Nyáyabhushan, the purohit or family priest of the Manárájáh. He teaches Smṛiti at Barigachhi, about ten miles to the north of Nuddea. I also heard a good deal of the Nyáya tole of Prasanna Chandra Nyáyaratna at Belpokhar, three kroses north of Nuddea. This Pandit was one of the six who signed the petition to the



Lieutenant-Governor, the other five being, I believe, Nuddea Pandits. He told me that he had twenty-two students, eleven *deçya* and eleven *bideçt* from Mithilá, Burdwan and Delhi.

The Smṛiti students are said generally to study at a tole for eight years, the Nyáya for ten years.\* All toles are closed for ten days in each month, *i. e.*, on the 1st (*pratipada*), the 8th (*ashtami*), 13th (*trayodaçi*) 14th (*chaturdaçi*) and 15th *paurnamasi* of each paksha or fortnight, beside two weeks for the Saraswatee pooja and occasionally for other parvas. In Nyáya toles they close from *Ratha* to *Rása*, *i. e.*, from *Ashádh*a to *Kártika* (five months). In Smṛiti toles they close for three months, from *Bhádra* to *Kártika*. But of course the studies are liable to irregular interruptions when the Pandits receive invitations from the zemindars. During the vacations the students go on begging expeditions (much as Hindoo and Buddhist ascetics have been famed for doing from immemorial times), or they return to their homes.

The studies at the Nuddea toles are chiefly confined to the following works, or parts of works, on logic and law :—

The chief works read in Nyáya or Logic are, besides the well known standard works, the *Bháshá-parichcheda* and its commentary the *Siddhánta Muktváli*.

1. For *Vyápti* or the doctrine of the syllogism (comprising also the endless subtleties on *pakshatá*, or the conditions and rules relating to the minor term in its connection with the major term and the middle), the commentaries on the *Didhiti* by Mathuránátha, Jagadiça and Gadádharma.

2. For *hetwabhasa* or the fallacies, the commentaries of Jagadiça and Gadádharma.

3. For *Sámányalakshana jnána* (one of the most abstruse discussions of Hindu logic, referring to the transcendental perception, by which the mind, as it were, seizes the class in the individual, or, more properly, sees all the individuals under the one now present to the eye), the commentary of Jagadiça.

4. The *Kusumánjali*, or the celebrated attempt of Udayana

\* Of course but for the continued interruptions the course of study could be finished in half the time.

Acharya to establish on Naiyáyik arguments the existence of the Supreme Being.\*

5. The Çabda çakti prakāçiká of Jagadīça.

The chief works on Law or Smṛiti are—

1. Parts of Raghunandana's Ashtávinçati Tattwa.
2. Dáyabhága.
3. The Çráddha viveka.
4. The Práyachchitta viveka.

The peculiarities of the Nuddea scholastic training may be summed up at once by a reference to that part of Bacon's *Novum Organon*, which describes the system of scholastic logic still current in his day. In the 29th Aphorism of the first book he says that those sciences which are founded on opinions and arbitrary dogmas have a natural affinity to anticipation rather than to interpretation, and to the scholastic logic rather than to his proposed induction, for their object was to subdue assent, not things; to win victory in a disputation over an antagonist, not to extend man's dominion over nature. We have here an exact account of Nuddea logic, and the class of men whom it tends to educate,—its sole end is *vichára*, to win victory at a festival by clever arguments which silence the opponent for the time being. Many Pandits devote most of their attention to the *purvapakshas*, *i. e.*, those parts of the popular treatises which give at great length the arguments of the opposite side to the author,—it being the established rule in Hindu dialectics that every writer must present at full his opponents' views and exhaust all that can be adduced in their favour, before he proceeds to overthrow all that has been brought forward and to establish his own opinion.† These Pandits are thus enabled to stock themselves with a store of plausible arguments to oppose a popularly received opinion, and thus to win the credit of ably supporting an apparently hopeless cause. The very form of Hindu logic necessitates

\* This has been edited with an English translation by the author of this Report.

† The writer has heard Pundit Iswar Chunder Vidyasagar relate how he first conceived his disgust at the native Nyáya, when as a student he once spent a week of hard labour to master some abstruse opinion, which day after day was elucidated and at length made clear by the teacher. When the class met the next day, the first thing they heard was, "now this view is only the *purvapaksha*, we must now proceed to shew that it is incorrect."

error,—it is so fatally bound up with technical terms, that it inevitably degenerates into a mere playing with words; and this tendency, which is to some extent an inherent fault in European, as well as Hindu, mediæval logic, becomes exaggerated to its height in the modern Nuddea school.

In three of the toles we had the students exercise themselves in a discussion; and it was very curious to watch the intense eagerness of the disputants, as well as the earnest sympathy of the surrounding students and Pandits. A successful sophism elicited a smile of approbation from all.

The subject of one of these disputations was *Sādhyābhāva* or the absence of the major term. I could not follow the intricacies of the argument, but its summary was as follows.—

All accept that *Sādhyābhāva* means the absolute absence of fire, as, *e. g.*, in a lake of water. But how is this to be understood?

*a.*—In the sentence the lake has the total absence of fire or is totally destitute of fire; it cannot be merely meant that *all* fire collectively is absent, because this equally applies to a volcano, as that has indeed fire, but it is only mountainous fire and not kitchen fire. The sentence would, in fact, be useless, as it would be as true of any thing in the world as of your lake,—nothing can have *all* fire in it. *b.*—Again, as the volcano has the absence of fire and a jar, *i. e.*, has not fire and a jar both together, this is another way in which we might say that the same description would apply (if unlimited) to a volcano and a lake. *c.*—If you say the lake has *Kebala-vahni-abhāva*, *i. e.*, has the absence of fire alone, this gives rise to a quibble on the meaning of ‘alone.’ This is met by defining it, as “it is not the absence of anything besides fire but only the absence of fire,” (বহ্নিতরের অভাব নহে কিন্তু বহ্নির অভাব), this stops the apparent fault (or fallacy) of *Ubhayapaksha*. Then comes the question, “what is the meaning of the absence of all fire?” It is explained by কোন বহ্নি না থাক, there not being any fire there,—now in the mountain there is *some* (কোন) fire, and it is the absence of *any* (কোন) that distinguishes the lake. Then comes the question, what is meant by ‘anything besides fire?’ Does fire mean here mountain-fire or any kind of fire, and so on, for ever? For the series of endlessly emerging quibbles is never stopped by the exhaustion of the subject, but only of the disputants or the audience.

At the present time all *vichāras* are of this kind,—not to elucidate the real meaning (for this is accepted on the authority of the writer), but to endeavour to establish or overthrow some verbal quibble which seeks to impugn the perfect accuracy of the definition.

In the teaching of the Pandits everything is directed to one end, *ad bene disputandum*. The primeval fault of the Hindu intellect has always been an excessive tendency to note the differences of things;\* and of course such teaching in logic and law only fosters this defect to the highest possible degree.

As a specimen, I would subjoin a disquisition on the nature of prohibition given by Pandit Brajanāth Vidyāratna, the leading teacher of Smṛiti.

A student was selected during my visit to his tole to read and explain a portion of one of Raghunandana's *Tattvas*. The passage brought up the question of prohibition or *Nishedha*, and this led to the Pandit's giving a lecture on its nature and object.

I must here premise that in Hindu logic there are three kinds of *abhāva*, i. e., non-existence or absence.† These are respectively called “antecedent” (*prāgabhāva*), “emergent” (*dhwansābhāva*) and “absolute” (*atyantābhāva*). The first is the non-existence of a jar before it is made, which lasts from eternity down to the moment of its production and then ceases. The second is the non-existence of a jar when it is broken, which begins from the moment of its fracture and goes on to eternity forward. The third or absolute non-existence is seen in such sentences, as “there is no jar on this spot;” even if you move the jar thereto, there will be no jar in its former spot. The non-existence is always seen necessarily *somewhere*, else the jar would be omnipresent.

Now the Pandit maintained that the object of “command” (or *vidhi*) was to produce action or activity (*pravṛtti*); and similarly the object

\* This tendency was at once the strength and weakness of the self-developed Hindu mind. Compare *Novum Organon*, i. iv. “Maximum et velut radicale discrimen ingeniorum, quoad philosophiam et scientias, illud est; quod alia ingenia sunt potiora et aptiora *ad notandas rerum differentias*, alia *ad notandas rerum similitudines*. Utrumque ingenium facile labitur in excessum, prensando aut gradus rerum aut umbras.”

† Properly there are four, but the fourth (mutual or inter-exclusive non-existence) does not come in here. This is in fact our ‘difference;’ thus a jar and a chair mutually exclude one another, i. e., they are different things.

of *nishedha* or "prohibition" was to produce the absence (or non-existence) of activity, *i. e. pravritter abhāva*. Now the question arises to which of the three kinds of *abhāva* does this belong?

He first shewed that it could not be the third or "absolute" *abhāva*, as this would imply that the absence *must* always exist somewhere, whether the prohibition be given or not. Neither could it be the "emergent," as this would imply that the actions prohibited must necessarily have been previously done, before the prohibition could exist,—as if there could be no such thing as prevention but only cure! He therefore, concluded by exhaustion that the non-existence of action which a prohibition produced in its hearers was "antecedent" or *prāgabhāva*. In other words, until the prohibition is promulgated, the actions which it is to prohibit are of course not prohibited; they are not, therefore, *so long* the objects of its injunction; they only become so from the moment of its being issued. From the moment of its issue, these actions are forbidden, *i. e.*, the hearer of the law will thenceforth not do them. There will therefore, in his case, be an absence of such prohibited actions, which will continue until he violates the law; and this absence will of course reach back to eternity, as until the prohibition came, he never could have committed them as prohibited. In other words, the non-existence of prohibited actions ceases only when, *after the prohibition*, some such action is performed.\*

This I think, is a fair and perhaps favourable specimen of the niceties of what Dr. Hall has well called "the arcana of Hindu dialectics."†

One of the things which most interested and surprised me in my visit to Nuddea was the great desire which I found everywhere existing for English education. Of course amongst the *bīdegi* students this did not exist; the grown up and elderly men who come to Nuddea to complete a purely Pandit education, only care for studies which will gain them reputation at home; but it is very different with the *degiya* students. I was continually receiving applications from the students for a free

\* The Pundit's reasoning is perhaps illustrated by Gibbon's remark on the injustice of a retro-active enactment, "which punishes offences which *did not exist* at the time they were committed." (*Autobiography*, p. 80.)

† A contribution towards an index to the Bibliography of the Indian Philosophical systems, p. 32.

education in the Sanskrit College; everywhere the desire was expressed for a good Anglo-Sanskrit School. Such a school would effect more than anything else to abolish prejudice and to let light into a district which has long been a home of superstition and bigotry. The Church Missionary Society have long had a grant-in-aid school there. During the time of the Reverend S. Hasel, Sanskrit used to be taught there to a certain extent; but what is wanted is a thoroughly good school, educating up to the Entrance Examination, and at the same time giving a sound training in Sanskrit Grammar and Poetry. Perhaps the existing school could be adapted to this purpose, if the Church Missionary Society were disposed heartily to enter into it. Anyway the establishment of such a school, either by the Church Missionary Society or by Government, appears to me to be a pressing want, and I should indeed rejoice if my visit resulted in such a measure. Compared to this, the question of improving the toles is a measure of very secondary importance.

This leads me to notice a very interesting feature in Nuddea, which I was much surprised to find, and which seems to me a very remarkable proof, how a public demand is beginning to make itself felt for a better education than that given by the toles, even among the orthodox Hindu population. I refer to the *Akhaḍās* (আখড়া). These are schools kept by pupils of the Smṛiti or Nyāya toles, who here become in their turn teachers of grammar. I visited two of these schools, one held in the house of Pandit Rām Nāth Tarkasiddhānta, and taught by Āri Nārāyaṇ Bhaṭṭācārjya and Āri Mādhav Bhaṭṭācārjya. Here there were twelve students. The second was held in the house of Pandit Rādhāballabha Bhaṭṭācārjya and was taught by Kumuda Nātha Āiromaṇi and several other tole students. Here there were twenty-five scholars. In this *Akhaḍā* three students had finished the native grammar Mugdhabodha, and began to read Kālidāsa's poem, the Kumāra Sāmbhava. I was interested to learn that two of the lads studying there were descendants in the seventh generation from the celebrated Pandit Jagadīṣa. In the first 'Akhaḍa' a little English was also taught, and the first book of reading was in use. This last fact seems to me most significant, that even in Nuddea, the centre of Hindoo exclusiveness, in a school entirely under the management of tole

students, a provision was made, however imperfect, for teaching some little smattering of the language and learning of the West.

The toles of Nuddea receive at present an annual pension from Government of Rupees 1,200. The history of this grant appears to be as follows :—

The Committee of Revenue found in 1784 that the Rájáh of Nuddea used to grant an allowance to the Paḍoós (পাড়োয়া) or Sanskrit students of the toles, and in September 1784 they appear, to a certain extent, to have sanctioned an annual grant of Rupees 1,200 to this object. It was paid from the Treasury of Nuddea, and distributed to the students by a person on the part of the zemindars.\*

On the 18th May, 1787 (further enquiry having been instituted) the Board of Revenue directed the Collector to continue the payment of the pension for the present, and to charge the same under the head of 'Pension.' On the strength of this order it was regularly paid to the students at the rate of Rupees 100 per mensem. In 1829, at the request of the Collector of Nuddea, the Civil Auditor (April 6th) made a reference enquiring as to the authority on which the pension was granted. The Board on the 6th June quoted their letter of the 18th May, 1787, and at the same time stated thus—"There is no mention whatever of this allowance on the accounts or correspondence relating to the decennial settlement; and if the payment has been continued without enquiring on the authority, it ought to be immediately suspended and a full explanation of the irregularity furnished by the Collector." The allowance was in consequence discontinued, but a remonstrance from the Nuddea students was received with the recommendations of the Moorsheebád Commissioners, dated 22nd January, 1830, and was submitted to Government on the 12th February.

Meanwhile the late Professor H. H. Wilson (then Junior Member and Secretary to the General Committee of Public Instruction) had visited the toles and reported on their state; and in a letter dated 3rd August, 1830, Government sanctioned the

\* Professor Wilson in his Report describes this distribution as it existed in his time, 1829. It was given to the bidesi students, i. e., those who came from places more than three days' journey from Nuddea, and it allowed them from twelve annas to one rupee per mensem.

continuance of the pension with arrears, and the payment has continued to the present time.

Professor Wilson remarks in his Report—"Although the value of the learning acquired at Nuddea may not be very highly estimated by Europeans, yet it is in great repute with the natives, and its encouragement even by the trifling sum awarded is a gracious and popular measure :'' of course, with the spread of English education, in Lower Bengal the native estimate of the value of "infinitesimal logic" and the toles which teach it, is gradually altering, and I have heard many of the most able English scholars among the natives speak somewhat strongly against the system. As it is at present conducted, there can be no doubt that the Nyáya toles of Nuddea teach very little that is of any worth, either for practical life or even the history of the human mind; but this partly arises, not from the barren nature of Hindu logic, but the barrenness of the special part of it, to which they exclusively confine their attention. It is, as if in Oxford we neglected the *Organon* of Aristotle, and exclusively studied "the Farrago of the Parva-Logica."\* But if the really great writers on Hindu logic were systematically taught in the toles of Nuddea, I should hardly be inclined to condemn as worthless all that the students would learn there. As it is, they learn only a part even of Nyáya, and I found that very few could read any portion of the *Kusumánjali*, or knew much beyond the endless intricacies of *Vyápti* and *pakshatá*. Here of course they were completely at home,—it was a marvel to see how completely.

I am hardly prepared to suggest a definite plan for the improvement of the Nuddea toles, because I think that this would require a practical acquaintance with Mofussil education, which I do not possess. But there are two suggestions which I would venture to make :—

1. It would be a great improvement, if some superintendence could be exercised over the Sanskrit studies, and if rewards could be offered for thorough proficiency in the studies of the place. At present the certain effects of neglect and the absence of all encouragement are plainly seen in the toles,—they do not teach well what they profess to teach, every thing is chilled by the want of উৎসাহ from those in authority. Now regular examinations (with many rewards) in

\* Mansel's *Aldrich*, Pref.



certain text books, held under the superintendence of the Inspector by such a Pandit of the Sanskrit College as Maheça Chandra Nyáyaratna, would give the needed stimulus. Examinations should also be held in the Mugdhabodha or Sanskrit grammar.

2. It seems to me very needful, that, as the *condition* of a liberal help for the Sanskrit studies, Government should insist on some amount of useful learning being also taught. Some arithmetic and perhaps geography and history, and (still better if it were but possible) some little Western Logic and Moral Philosophy would be an invaluable auxiliary and corrective to the peculiar training of a tole. Of course this must all be given in Bengali, and I have no doubt that a sound knowledge of Bengali itself is very rare at Nuddea, even among great Sanskrit scholars. In this way we should break into the narrow circle of prejudice and exclusiveness which hedges round so closely the students of Nuddea, and we should fit them for exercising a beneficial influence on their countrymen. At present they necessarily belong to the past, and are utterly unable to sympathise with or understand the mighty movements round them. A Nuddea student is an exact counterpart to Gibbon's description of the sophist Libanius, "a recluse student, whose mind, regardless of his contemporaries, was incessantly fixed on the Trojan War and the Athenian Commonwealth." Still, after all, their position and training unavoidably give them great influence among their countrymen, especially away from the towns. This influence is, no doubt, at present used everywhere against the progress of education and social improvement; but surely it would be an object well worth striving for, if we could improve, not abolish, the time-honoured tole, and if we could change the character of the students whom its system tends to form, into sound Sanskrit scholars instead of disputatious pedants, and into the friends, instead of the enemies, of native education.

I beg to forward you the above Report, and I must express my deep regret that I have so long delayed sending it. Much of it was written in India before I left, and I had hoped to send it completed soon after my arrival in England, but ill-health and prostration of energy precluded it, and subsequently I found it very difficult to collect the scattered fragments of my notes into a narrative. As it is, I feel it is very imperfect, and had I my Pandit Maheça Chandra by my side, I could easily increase its value tenfold.

As you have expressed a desire to have my Report, such as it is, I have resolutely gone over all my notes and memoranda and rewritten the whole, and I send it with all its shortcomings and defects. It is not easy to write a Report on Nuddea in England. Little details have escaped me which I overlooked at the time, and which I now cannot supply; but I feel sure that the general impression I derived from my visit to the toles is still as vivid as it ever was.

8. From the Secretary to the Government of India in the Home Department, forwarding copies of a report on the manufacture of China grass by Mr. McClintock, American Vice-Consul at Bradford.

Revenue.

*India Office, London, 7th March, 1867.*

No. 12.

*To His Excellency the Right Honorable the GOVERNOR-GENERAL of India in Council.*

SIR,—I transmit to your Excellency in Council thirty copies of a Memorandum, by Mr. McClintock, American Vice-Consul at Bradford, respecting the manufacture of China Grass, and the price which can be obtained for it in this country, which I have received from Her Majesty's Secretary of State for Foreign Affairs.

2. Lord Stanley, in transmitting this paper, informs me that he has ascertained, through the Bradford Chamber of Commerce, that the importance attached by the writer of the Report to this article is not exaggerated, and that nothing but its high price stands in the way of its being largely consumed.

3. Under these circumstances, I agree with the Secretary of State for Foreign Affairs that it will be useful to forward copies of the Report to any of the Officers of your Presidency who reside in places which may be favorable to the cultivation and export of this grass.

I have, &c.,

No. 4159.

CRANBORNE.

Copy of this Despatch, together with three copies of the Report referred to, forwarded to the Secretary, Asiatic Society, Bengal, for information.

By Order, \*

(Sd.) A. P. HOWELL,

*Under Secy. to the Govt. of India.*

*Fort William, Home Department ;  
the 22nd April, 1867.*

*Report by Mr McClintock, American Vice-Consul at Bradford, respecting the Manufacture of "China Grass."*

*Consulate of the United States, Bradford,  
December 15th, 1865.*

The Chinese have for centuries made, by hand labour, various descriptions of "grass cloth," well known in America and Europe, and often of great strength and beauty, from the fibre of the *Boehameria cordata* or *Urtica nivea*, known in commerce as Chinese grass.

Large quantities of the grass have at various times been brought over to England, and probably also to the United States, in the hope of finding a market among the dry goods manufacturers who are always on the look-out for new materials; but it has hitherto been, and it is even now, found impossible to produce a true "grass cloth" by machinery. The fibre is rather brittle, though very strong, and it is found that the China grass cloth of commerce is only to be woven by hand labour, in which, of course, the Chinese themselves are beyond the reach of competition. Large quantities of the grass have, therefore, been in store in London and elsewhere for years. Some enterprising manufacturer would occasionally purchase a few tons with which to make experiments; but the only result for a long time was, that he who experimented the most, lost the most. Thousands and even tens of thousands of pounds were sunk by one and another, who each fancied for a time that he had discovered the true method of working up this intractable substance. Whether it was tried in the United States or not, I do not know; but the concurrent testimony of my American friends in the trade is, that no one is now successfully working it at home. Within two or three years past, however, several firms in this neighbourhood have succeeded, by chemical means, in bringing the fibre into a state most closely resembling the best mohair or other bright worsted, and have worked up great quantities of the refined material as a substitute for worsted in many kinds of stuff goods, always, however, in combination with cotton (the warp being of cotton and the weft of the China grass), as they have not yet been able to work it properly alone.

The manufacture of worsted goods—that is, of goods made of long-staple wool, as distinguished from short-staple or ordinary wool—

has become an immense trade, of which Bradford has at present almost a monopoly, although the manufacture has lately been extending in many parts of New England. Four-fifths of these goods are of mixed material—that is, are made with cotton warps. And for many articles of the kind, especially for those requiring a stiff, strong, and cool texture, combined with a glossy, silky appearance, it is found that the prepared China grass makes the very best material.

Of course, the grass manufacture is yet in very few hands, but its development already, even within the last few months, has been signally rapid. The market value of the raw material has for some years past maintained itself at the very high rate of about 80*l.* per ton, which price it is supposed cannot be much lessened for many years to come. Two things are certain in this respect: one, that there is now, and will be here, a practically limitless market for all raw “grass” that can be imported at from 70*l.* to 80*l.* per ton; the other, that under any fluctuations of the market the material is intrinsically so valuable that it will always in the future command a price as high as that of cotton, and nearly or quite as high as that of worsted itself, if not even higher.

Here, then, is a great and rapidly increasing market for a certain vegetable production at a very high price. In America we have, on the other hand, vast tracts of country which, being in the same latitude and with very much the same climate as those districts of China of which the grass is native, should be able to grow this production to great advantage. Why not, then, introduce its culture?

It seems certain that the manufacture of the grass fibre will be established in our country at no distant day; but in the meantime there is a market in England for all that we can conveniently grow. It is, for our planters, simply a question of experiment with the seed, having in view the market price of the raw produce. Successful experiments have been made very recently in Java and in India, proving that the grass will grow in any climate warm enough for the culture of cotton and sugar, provided the ground chosen be sufficiently moist.

I venture to suggest that further information, as well as quantities of the seed, &c., can doubtless be furnished by our Consular Officers in China, especially, perhaps, by the Consul at Hankow,

that place being the chief market for the grass which is brought thither from the interior, and often from a great distance.

The receipt of the following communications was announced.

9. From C. F. Amery, Esq., "On the origin of races."

10. From Bábu Pratáp Chandra Ghoshe, B. A. "On the Adjustment of the Hindu Calendar."

11. From Dr. J. B. Davies, the Ethnology of India.

At the request of the President, Bábu Pratáp Chandra read his paper, of which the following is an abstract.

The Hindu Civil year is a practical modification of the Hindu astronomical year. The astronomical year is determined by the period between two consecutive conjunctions of the sun with Aṣwini ( $\beta$  Arietis) the first asterism of the Constellation Aries. In determining the civil year we have only to reject the fractions of a day: thus, if the sun enter the first point of Aries at or after midnight of the 12th April, a day is to be added to the expiring year; or, if the sun enter on the morning of the 12th, we reject the day from the year.

The Hindu calendars placing the conjunction of the sun on the 13th April of the current year begin the year on that day. By a reference to European Tables and the solution of a few simple spherical triangles it is shown that the ecliptic conjunction of the sun with  $\beta$  Arietis happens in the present day between the 21st and 22nd April. The initial moment of the year was placed in former times on the vernal equinox, when the sign and the constellation Aries coincided. Owing to the retrograde motion of the equinoxes and to the neglect of Hindu astronomers in correcting the time of the first moment of the year, it has slowly advanced from the equinox at the rate of one day in 72 years.

The first moment of the Hindu year retains in its name the idea of its coincidence with the vernal equinox and the first moment of the ecliptic conjunction of the sun with the first point of Aries, a phenomenon that does not exist.

The vernal equinox is removed from the first of Vaiśākha by a period of about 22 days, and the moment of ecliptic conjunction of the sun with  $\beta$  Arietis is about 7 days in advance of the date. The paper is an attempt towards so adjusting the Hindu Calendar as will

make its indications agree with reality. To make the year begin with the ecliptic conjunction of the sun in the vernal equinox is an impossibility. To retain then the full idea which the name *mahá vishuva mesha sañkránti* conveys, is out of the question. The year must then be commenced at either of the two dates, the 10th of March, or the 22nd of April. The latter is preferred on account of the advantages the new method will confer on calculations.

A translation of the principal points of a circular issued in Sanscrit is appended. This quotes the most authoritative passages, showing that a change of the beginning of the year on account of the precession of the equinoxes is not contrary to the Çastras, with a Hindu the authority of the Çastra being the only argument.

Some doubts as to the propriety of performing the *Ghatotsarga* ceremony on the 31st of Chaitra having arisen, Professor Bāpu Deva of Benares was addressed on the subject. The Çāstrī replied favourably. His reply, with the original query, is appended to the circular. The circular quotes passages from the *Súrya Siddhánta*, the *Soma Siddhánta* and other astronomical works, to show that the Hindu authors admit of and give rules for determining the motion of equinoctial points.

Read a letter from Major C. H. Strutt, enclosing the following description of a coin of *Sophytus*.

Obverse.



Reverse.

*Obverse.* Head with helmet and cheek plates, a crown of laurel wreath over the helmet ; no inscription.

*Reverse.* A cock in splendid preservation with a Greek inscription perfectly plain, ΣΟΦΥΤΟΥ "of Sophytus." Monogram with the Caduceus or Mercury's Rod.

Purchased somewhere in the Peshawur district, from a zemindar, together with several coins of the Bactrian series, a gold Diodotus, two Alexander the Great's coins, and one of the *Bucephalus* coins. All of these coins are in perfect preservation.

## LIBRARY.

The Librarian submitted a list of books added to the Library since the last meeting.

• *Purchase.*

Reise der Oesterreichischen Fregatte Novara. Zoologischer Theil. Lepidoptera. By Dr. C. Felder.

Dictionnaire Turc-Arabe-Persan. By Dr. J. T. Zenker. Heft XI.

Sanscrit Wörterbuch. By Otto Böhtlingk and R. Roth. *Bogen* 31-40.

Revue et Magasin de Zoologie, 1867, No. 2.

Revue des deux Mondes. 1st and 15th Mars, 1867.

Ibn-el-Atheri, Vol. I.

• Comptes Rendus, Tom. LXIV. Nos 8\* to 12, 1867.

The Indian Medical Gazette, Vol. II. Nos. 5, 6.

Hewitson's Exotic Butterflies, No. 62.

The Journal of sacred Literature, April, 1867.

The Quarterly Journal of Science, April, 1867.

Journal des Savants, March, 1867.

The Annals and Magazine of Natural History, April, 1867.

Catalogue de Livres Anciens et Modernes, Supplement.

The Westminster Review, April, 1867.

The Calcutta Review, May, 1867.

*Exchange.*

The Athenæum for Feb. 1867.

*Presentations.*

Transactions of the Royal Irish Academy:—Science, Vol. XXIV. Parts VII. VIII.—THE ROYAL IRISH ACADEMY.

Proceedings of the Royal Irish Academy, Vol. IX. Part IV.—THE ROYAL IRISH ACADEMY.

Proceedings of the Royal Geographical Society, Vol. XI. No. 1.—THE ROYAL GEOGRAPHICAL SOCIETY.

Memoirs of the Geological Survey of India, Palæontologia Indica Vol. V. Parts 1-4.—THE GOVERNMENT of India.

Jahrbücher der K. K. Geologischen Reichsanstalt. Band XV. 1865, No. Jänner, Febr. Merz:—The K. K. Reichsanstalt.

Alt-arabische Gedichte über die Volkssage von Jemen, als Textbelege zur Abhandlung "Ueber die süd-arabische Sage," by A. von Kremer.—THE AUTHOR.

The History of India by the Hon'ble M. Elphinstone, translated into Urdu, No. 9.—**THE SCIENTIFIC SOCIETY OF ALLIGURH.**

Bulletin de la Société de Géographie, Mars, 1867.—**THE SOCIETY.**

Abhandlungen der Königlischen Academie der Wissenschaften zu Berlin, 1865.—**KÖNIGL. PREUSS. AKADEMIE DER WISSENSCHAFTEN.**

Proceedings of the Royal Society of London, Vol. XV. Nos. 90, 91.—**THE ROYAL SOCIETY.**

Journal Asiatique; VI. Series, No. 32.—**THE SOCIÉTÉ ASIATIQUE.**

Selections from the records of the Bombay Government, No. CII. New Series.—**THE GOVERNMENT OF BOMBAY.**

Palæontologia Indica, V. 1-4. The Gasteropoda of the Cretaceous Rocks of S. India, by Dr. F. Stoliczka.—**THE GOVERNMENT OF BENGAL.**

Cours d'Hindustani à l'Ecole Impériale et spéciale des langues orientales vivantes près la Bibliothèque Impériale. Discours d'Ouverture du 3e Décembre, 1866.—**THE AUTHOR.**

The Fishes of Zanzibar.—BY **LIEUTENANT-COLONEL R. LAMBERT PLAYFAIR AND A. C. L. G. GUNTHER**:—**THE GOVERNMENT OF BOMBAY.**

Annual Report of the Geological Survey of India and of the Museum of Geology, Calcutta, 1866-67.—**THE SUPERINTENDENT OF THE GEOLOGICAL SURVEY OF INDIA.**

Proceedings of the Society for the Diffusion of Useful Knowledge in the Panjáb, Nos. XI. to XV.—**THE SOCIETY.**

The Pundit, Vol. I.—**THE EDITOR.**

Professional papers on Indian Engineering, Vol. IV. No. 15.—**THE EDITOR.**

Journal of the Agricultural and Horticultural Society of India, Vol. XIV. Part IV.—**THE SOCIETY.**

The Journal of the Statistical Society of London, March, 1867.—**THE SOCIETY.**



PROCEEDINGS  
OF THE  
ASIATIC SOCIETY OF BENGAL,  
FOR JULY, 1867.



The Monthly General Meeting of the Asiatic Society was held on Wednesday the 3rd July, at 9 P. M.

Dr. J. Fayrer, President, in the chair.

The Proceedings of the last meeting were read and confirmed.

Presentations were announced—

1. From L. Jackson, Esq., a specimen of texture woven by insects, found near Gowas, in Zillah Moorshedabad.

2. From Dr. Hildebrand of Honolulu, through Dr. J. Anderson, a copy of the Grammar of the Hawaiian Language by L. Andrews, and a copy of a Dictionary of the Hawaiian Language by L. Andrews.

3. From Sir D. Macleod a photograph of a *Zungámi*.

The following gentlemen, duly proposed at the last meeting, were balloted and elected as ordinary members.

Dr. C. Macnamara.

N. A. Belletty, Esq.

Dr. J. J. Wood.

• C. A. Hacket, Esq.

The following were candidates for ballot at the August meeting :—

C. F. Amery, Esq. Superintendent Arboriculture, Lahore, proposed by P. H. Egerton, Esq., seconded by Dr. J. L. Stewart.

Theodore H. Hughes, Esq., F. G. S., proposed by Mr. Mallett, seconded by Mr. Ormsby.

W. L. Granville, Esq., Civil Architect, proposed by Dr. J. Anderson, seconded by Mr. M. H. Ormsby.

R. H. Curran, Esq., L. R. C. S. I. and L. K. & Q. C. P. I. Indian Medical Staff, proposed by Mr. V. Ball, seconded by Mr. M. H. Ormsby.

F. Wilcox, Esq., Bengal Police, Purulia, proposed by Mr. V. Westmacott, seconded by Dr. J. Anderson.

A. Oldham, Esq., C. E., E. B. Railway, proposed by J. M. Scott, Esq., C. E., seconded by J. P. Collis, Esq., M. D.

The receipt of the following communications was announced.

4. From Lieutenant A. Pullan,—Remarks on some ancient ruins in the Gurhawl Bhatur.

5. From C. Horne, Esq.,—Notes on Mynpuri Villages, Asowle.

6. From W. T. Blanford, Esq., A. R. S. M., F. G. S.,—Zoological Notes.

At the request of the President, the following paper was read by the Author.

*On the Jungle products used as articles of food by the inhabitants of the districts of Munbhoom and Hazaribagh (Chota-Nagpore).—By V. BALL, Esq. B. A., Geological Survey of India.*

In introduction, Mr. Ball said.—“Last year I read before the Society a short paper which was written from such material as I happened to have by me. It was intended merely to convey an idea of the means of support on which large numbers of the natives had to rely during the famine; the subject being one of particular interest at that time. During the past working season I have made systematic enquiries, and am now enabled to lay before the Society an approximately complete list of all the Jungle products used as articles of food.”

The products are divided, in the list appended to the paper, under six headings, viz. fruits and seeds, flowers, leaves, stems, roots and fungi. These headings embrace upwards of 70 distinct species of plants, all of which yield more or less nutritious food. In most cases the Bengali and Hindustani names are given in addition to the Latin synonyms.

A full account of the particular uses, manner of preparation and value of the more important products formed the principal subject of the paper. According to the Author the various species are by no

means of equal value. While some furnish, so to speak, staple articles of food, others can only be regarded as edible, and in a few cases are even injurious, if eaten in large quantities.

The paper was illustrated by a collection of dried specimens which was inspected by the members.

The author, in answer to a question from the President as to whether he had understood him to say that a number of the people lived for a portion of every year on these products, replied that some of the aboriginal tribes, such as the Sonthals and Coles, as well as the poorer classes of Hindoos, depend solely upon the jungle to furnish them with the means of subsistence for from two to three months of every year.

Several members asked questions in reference to the Mhowa and other plants, specimens of which were exhibited.

The Secretary then read Mr. Amery's paper on the origin of races, of which the following is an abstract.

Mr. Amery, in the earlier portion of his paper, enters at some length into the known facts of the distribution of animals and plants over the surface of the world in distant provinces, the relation of these provinces to climate, the representation of species in similar climate, the influence which altitude in ascending mountains has upon the fauna and flora, and the resemblance of the results to those observed upon the earth's surface in passing from the equator to the poles. It is also shewn that distinct forms occur in widely separated countries, of which the climate is similar, as in tropical Asia and tropical America, and that this is not due to the unfitness of each region for the support of foreign forms of life, since, in many cases, they thrive if introduced. In other instances, the same forms are found existing in widely separated regions, as in the case of the floras of Northern Europe, and that of the Western (?) slopes of the Himalayas. Hence it is inferred that neither soil, climate nor any existing conditions have influenced the distribution of the fauna and flora of the globe.

Some illustrations of the replacement of animals by distinct forms in other regions are then given. The author considers that there is a relation between the animals and plants, also between them and man of each region. Mankind, he considers as constituting a genus, comprising several well marked species, some of the peculiar characters

of which are illustrated in the physical and mental characters of the Australian, American-Indian, Negro, Mongol and Caucasian.

The aboriginal Australian has never learned to work in metals nor to till the land, nor does he learn in contact with the European. • He is a hunter by nature, but his highest weapon is stone or bone tipped. He has not advanced to the fabrication of the bow and arrow. Had he come in contact with large carnivorous animals, the race would have been annihilated.

The Red man of America is a slight advance on him ; he uses the bow and arrow, tills the soil, and makes himself formidable to such animals as he comes in contact with. The African is a further advance. The Mongolian takes us over a vast moral and intellectual gulf. And lastly comes the Caucasian, the highest existant type, mentally and physically. The Author considers that every argument which has been advanced in support of the unity of the race will be found, if tested critically—a vain effort to reconcile facts with a preconceived theory. The colour of each race is shewn to be quite independent of climate to which it has been attributed ; the black Negro, red Indian and yellow Mongol maintaining closely the same complexion in tropical and temperate and even in some cases in Arctic climates ; while other physical peculiarities, such as the thick lips of the Negro and the facial peculiarities of the Mongol, are shewn to be equally persistent. The mental faculties of different races are equally marked and appear to have always been so. The child of a Yorkshire peasant can by education be made the equal of the most learned in the land, while the child of an Australian is only capable of learning up to a certain point. The writer of the book of Job, the oldest Caucasian record, was the equal in mental calibre of the great men of the present day. Hence, barbarian tribes belonging to a civilized race like the Caucasians, are capable of civilization, while races like the red Indian and the Tasmanian are not.

The geological record shews that in past times, changes in the relative position of land and sea took place, and that the fauna and flora of each region have been entirely changed several times. The author considers that “ each distinct region of the dry land of the globe belongs to a distinct geologic era, that its fauna and flora represent the prevailing types of that era over all the land then above water,

and that remnants of every creation or nearly every creation, from the Permian era down, are left to shew what the earth was." New Zealand and Norfolk Island are especially cited as being a surviving remnant of the carboniferous epoch, or of a time immediately succeeding it. This is shewn by their monocotyledonous plants, palms, cycadeæ, and tree ferns, by the absence of quadrupeds, by the birds, the highest representatives of animal life, and by the fish in no way differing from the fossil representatives of the carboniferous age.

Australia appears to be the next oldest region; it has a fauna and flora distinct from that of New Zealand, and representatives of them are found in the European tertiary rocks. It contains no rocks of secondary age. The author considers that the causes of the differences from the fauna and flora of New Zealand are not explicable by the Darwinian theory, but that they must have been a new creation, which is now dying out before the animals and plants introduced by the white man. A similar distinction may be traced in America, Africa, the Malay land and Mongolia. Lastly comes the country of the Caucasian, resting upon the nummulitic rocks. Its upheaval wasted the previously divided Malay land, Africa and Mongolia, but it contains a fauna and flora distinct from those countries. The author states that the place of the nummulitic formation is not precisely determined, but that he is inclined to consider it a coast formation, contemporaneous with the chalk, a deep sea deposit.

The several types of man each occupy an area, corresponding to the different geological and botanical provinces, and the author thinks it improbable that he is not part of the same original creation. He points out, as a remarkable coincidence, that the race peopling every geologically newer region, is higher in the scale than the race of the next older region. The New Zealander is an exception, as the country appears to have been peopled by a Malay colony.

Mr. Ormsby said that he thought most of the facts brought forward by Mr. Amery had been known for a very considerable time. The idea of the organic remains in certain geologic formations in one part of the world being represented by the living flora and fauna of another is by no means new. Professor Owen, in his "*Palæontology*," (Ed. 1860, p. 307) compares the English oolite with Australia of the present day. He concludes his arguments by saying that the

animals and plants which now flourish in the Australian continent appear to complete a picture of the ancient condition of the earth's surface, which has been superseded in one hemisphere by other strata and a higher type of mammalian organization. Mr. Amery states as an evidence of the low condition of the aboriginal Australian that "his highest instruments are stone or bone tipped," and from this fact, in connection with others, appears to come to the conclusion, that the Australian man is an *animal* inferior to the Caucasian. Further, our author "would as readily believe in the Lamarckian or Darwinian theory of progressive development as in the descent of the Germanic and Australian races from one pair of parents." So far as this conclusion is derived from any arguments based upon the fact of the Australian savage using stone and bone tipped weapons, it is clearly untenable. Flint implements are found in abundance all over the surface of the globe, resembling in many respects those now used in Australia. This fact evidently does not prove that our ancestors who used these primitive instruments belonged to a lower species of men than we ourselves do. Mr. Amery surely can never have intended such a conclusion to be drawn from his interesting paper.

Dr. Colles said—"I do not think that any argument in favour of the former existence in Europe or elsewhere of a race similar to the modern Australians can be derived from the similarity between the flint weapons dug up in Europe and those used by the Australians at this day. In Argos and Etruria, in the earliest Irish churches, and in the ancient American buildings, we find precisely the same architectural style used, because in all these cases buildings were erected by men who found large stones ready to their hand, and had no occasion to make use of the arch—yet none but the wildest enthusiasts assert that the Peruvians and the Pelasgi are one race. Similarly, mankind in any country would be at first obliged to make their cutting instruments of stone, and, working with that material, would in every place turn out weapons much resembling each other. So men of the most different race have all, at one time or other of their history, been obliged to produce fire by rubbing sticks together, or to use the bow in hunting or warfare, for want of better expedients. The fact that bows are now used by the red men of America, and were used in England four hundred years ago, is no proof that England was inhabited by red men in the 15th century."

Mr. Waldie remarked that Dr. Colles's argument scarcely seemed complete. Mr. Amery would probably say that the higher types of man could make opportunities and create circumstances; the lower could advance only a certain length, he could carry improvements no further.

Mr. Justice Phear observed that the writer of the paper, would have greatly strengthened his illustration of the "Yorkshire Boy," if he had pointed to a living example of one in the position which he described, and could have shown that it justified his remark. So long as the instance adduced remained purely a matter of speculation, Mr. Phear was disposed very greatly to doubt, whether the boy, whose ancestors had in a continuous chain from the days of Canute to the present time invariably been peasants, and unable without exception to raise themselves out of the lowest social grade, would exhibit the comparatively superior intellectual capacity which Mr. Amery expected of him. And with reference to the colour of the skin used as an argument for diversity of origin, although it might be conceded that it is not a function of latitude or temperature, and not referable to exposure as a cause, still this did not leave it to be treated as unqualified evidence, without any reference whatever to its association with language. The fact that the darkest races of Asia and the fairest of Europe, exhibit a common bond of union in their language, introduces a difficulty in the way of solving Mr. Amery's problem, which that gentleman seems to have passed by unheeded. The paper everywhere appeared to disclose traces of hasty composition, and it would probably not be incorrect to conclude that it was written without opportunity for thoughtful reflection. It would hardly be fair to the author that it should be published in its present form.

Mr. Blanford said that Mr. Amery's paper had probably been written under the disadvantage of a want of any books of reference, even the most elementary. It was only possible in this way to account for the numerous errors it contained in matters of fact, such as the assertion that cervine animals abounded in Africa, or that the age of the nummulitics was unknown. The principal theory insisted upon, that of the affinity between the fauna and flora of certain geological periods, and those of existing geographical provinces was not new, and it was easy to shew that it was merely apparent. The speaker proceeded to examine the case of New Zealand especially quoted by Mr. Amery. The only similarity between the carboniferous flora and

that of New Zealand is not, as asserted in the paper, the presence of monocotyledonous plants or cycads, the first of which are very rare and the latter barely represented in the coal flora, but in the very large percentage of ferns and conifers in each case; and this is merely a case of external resemblance, for the ferns and conifers are not the same, and those of New Zealand are no more closely allied to the genera and species of the coal than the conifers and ferns of other countries are. Turning from the flora to the fauna, the resemblance vanishes. It is not the fact, as stated by Mr. Amery, that no quadrupeds were found in New Zealand at the time of its discovery. A rat was met with, and if, by quadrupeds, mammalia were implied, it should not be forgotten that bats, including forms peculiar to New Zealand, are common, and that cetacea occur around the coast. The gigantic birds are as completely unrepresented in the carboniferous epoch as are the mammals, and the fish and mollusca inhabiting New Zealand at the present day are closely allied to those inhabiting other parts of the globe, and have no connexion with those found in carboniferous rocks; while the reptiles, fish and mollusca of the carboniferous epoch are in many instances, the two first especially, better represented in other parts of the world at the present day than in New Zealand. As regards man, Mr. Amery's idea of the Malay origin of the New Zealander would probably be a novelty to the members of the Society who had studied Ethnology. Indeed the whole of Mr. Amery's argument was based upon imperfect data. At the same time Mr. Blanford was quite willing to admit that the different races of mankind differed quite as much from each other as races of lower animals which have been universally considered distinct species, and that the idea of mankind being a genus comprising several different species was perfectly tenable, but he thought no evidence whatever had been brought forward to shew any connexion between these races and geographical or geological provinces. Some races of men, as the Mongolians, inhabited two or more regions, each possessing a distinct fauna and flora. In conclusion, Mr. Blanford believed that Mr. Darwin, in the chapters on geographic distribution in the "Origin of Species," had satisfactorily explained most of the phenomena alluded to in Mr. Amery's paper, despite Mr. Amery's somewhat contemptuous allusion to the "Darwinian theory."

Mr. Blanford then read a few extracts from his paper:—"Zoological Notes."



## LIBRARY.

The following additions were made to the Library since the Meeting held in June last :—

• *Presentations.*

Selections from the Records of the Madras Government.—THE GOVERNMENT OF MADRAS.

Bulletin de la Société de Géographie.—THE PARIS GEOGRAPHICAL SOCIETY.

Schriften der Naturforschenden Gesellschaft in Danzig ; Neue Folge. Band I. Heft II. Beobachtungen der Magnetischen Declination in Danzig und Bemerkungen dazu, by E. Kayser.—NATURFORSCHENDE GESELLSCHAFT IN DANZIG.

Report on the Land Revenue Administration of the Lower Provinces for 1865-66.—THE GOVERNMENT OF BENGAL.●

The Annals of Indian Administrations, Vol. X pt. IV.—THE GOVERNMENT OF BENGAL.

Natuurkundig Tijdschrift voor Nederlandsch Indie, uitgegeven door de Koninklijke Natuurkundige vereeniging in Nederlandsch Indie. Deel XXIX Afl. 2-4, 5-6.—THE BATAVIAN SOCIETY.

The Journal of the Bombay Branch of the Royal Asiatic Society, Vol. VIII. No. XIII. for 1863-64-65.—THE SOCIETY.

The Journal of the Chemical Society, Oct., November, and December, 1866, January, February and March, 1867.—THE SOCIETY.

Ten copies of a Review of "An Introduction to Kachchayana's Grammar of Pali Language, by J. D. Alwis Colon, 1863," by Professor A. Weber.—THE EDITOR.

Actes de la Société d'Ethnographie, Tome I. Liv. 8.—THE SOCIETY.

The Report of the British Association for the advancement of Science, Birmingham, 1865.—THE BRITISH ASSOCIATION.

Architecture at Bejapoor.—THE GOVERNMENT OF INDIA.

Architecture at Dharwar.—THE GOVERNMENT OF INDIA.

Architecture at Ahmedanagar.—THE GOVERNMENT OF INDIA.

Report of the Committee of the Bengal Chamber of Commerce, from 1st November, 1866, to 30th April, 1867.—THE BENGAL CHAMBER OF COMMERCE.

Magnetical and Meteorological Observations made at the Government Observatory, Bombay in 1864.—THE GOVERNMENT OF BOMBAY.

Lecture on Military Gossip, by Captain T. C. Anderson.—**THE AUTHOR.**

The Quarterly Journal of the Geological Society, No. 90, May, 1867.—**THE GEOLOGICAL SOCIETY OF LONDON.**

Proceedings of the Royal Society of London, No. 92.—**THE ROYAL SOCIETY.**

Natuurkundige Verhandelingen van de Hollandsche Maatschappij der Wetenschappen te Haarlem ; on the Peculiar Crania of the Inhabitants of certain Groups of Islands in the Western Pacific, by Dr. J. B. Davis.—**THE AUTHOR.**

*Purchases.*

Revue des Deux Mondes, 1st and 15th April, 1st May, 1867.

Revue et Magasin de Zoologie, No. 3, 4, 1867.

The Annals and Magazine of Natural History, Vol. 19, No. 113.

The Edinburgh Review, No. 256.

Journal des Savants, February, April, 1867.

Comptes Rendus, Tome LXIV Nos. 13, 14, 15, 16, 17.

Reise der Oesterreichischen Fregatte Novara um die Erde in den Jahren, 1857, 1858, 1859, unter den Befehlen des Commodore B. von Wüllerstorff-Urbair ; Linguistischer Theil, by Dr. F. Müller.

Ditto, Zoologischer Theil, Band I, Fische, Dritte Abtheilung, by Dr. R. Kner.

Reptilien, by Dr F. Steindachner.

Conchologia Iconica, by L. Reeve, pts. 262 and 263.

Gould's Birds of Asia, pt. XIX.

The Ibis, Vol. III No. 10 (new series).

The Numismatic Chronicle and Journal of the Numismatic Society, pt. I., 1867.

Wolf's Zoological Sketches, 2nd series, parts, XI and XII.

*Exchange.*

The Athenæum, April, 1867.

PROCEEDINGS  
OF THE  
ASIATIC SOCIETY OF BENGAL,

FOR AUGUST, 1867.



The Monthly General Meeting of the Asiatic Society of Bengal was held on Wednesday the 7th August, at 9 P. M.

Dr. J. Fayer, President, in the chair.

The minutes of the last meeting were read and confirmed.

Presentations were announced—

1. From Lieutenant-Colonel B. Ford: Imperfect skeletons of an adult and of a foetal Dugong.

2. From Bábu Shib Chunder Shome: a copy of History of Orissa in Bengali.

3. From Colonel H. L. Thuillier: six copies of Major Tennant's paper on the Eclipse of August, 1868.

Three copies of Professor Airy's Notes on the Eclipse of August, 1868.

From Monsieur Le Chevalier Cristoforo di Negri, through Dr. C. F. Tonnerre, a copy of *La Storia Politica Dell' Antichita paragonata alla moderna*, 3 Vols.

4. From the Government of Bengal, four copies of extracts from the Proceedings of the Bombay Government.

Letters were read—

1. From the Government of Bengal in the Public Works Department, enclosing a copy of a report on an Earthquake felt in Sylhet at 1 P. M. on the 2nd of February, 1867.

2. From the Secretary to the Government of the North Western Provinces forwarding a copy of a report on the tribes of Jhansie or Scherias of Lulletpore.

The following gentlemen, proposed and duly seconded at the last meeting, were balloted for and elected as ordinary members.

C. F. Amery, Esq.

T. H. Hughes, Esq., A. R. S. M., F. G. S.

W. L. Granville, Esq.

R. H. Curran, Esq.

F. Wilcox, Esq.

A. Oldham, Esq., C. E.

The following gentlemen are candidates for ballot at the September meeting.

1. The Rev. W. Fyfe, Superintendent of the Free Church Institution, Calcutta, proposed by Mr. W. S. Atkinson, seconded by Mr. M. H. Ormsby.

2. Captain V. Gauvain, Messageries Impériales, steamship Meinam, proposed by Mr. Grote, seconded by Colonel C. S. Guthrie.

3. A. J. Hughes, Esq. C. E., proposed by Mr. J. M. Scott, seconded by Mr. M. H. Ormsby.

4. Lieutenant Butler, Assistant Commissioner, Gowhatty, Assam, proposed by Mr. Locke, seconded by Mr. W. T. Blanford.

5. M. Place, Consul General of France, proposed by Mr. A. Grote, seconded by Mr. M. H. Ormsby.

Dr. A. C. Macrae, whose retirement was announced in May, 1866, owing to a mistake, was reinstated in the list of members, from May last, the date of his arrival from England.

The following gentlemen have intimated their desire to withdraw from the Society.

Lieutenant W. Ramsden.

Captain M. Lloyd.

Lieutenant-Colonel H. Ballard, C. B.

The receipt of the following communications was announced—

3. From Lieutenant W. J. Williamson: "A Garrow Vocabulary."

4. From F. S. Growse, Esq., M. A. Oxon. B. C. S., "A translation into Latin Elegiacs of a Hindu Poem in the Sabhá Vilāsa."

The President then announced that Bábu Jádava Krishna Singha, a member of the Philological Committee, died of apoplexy on the 23rd of July, at the early age of 35 years.

He joined the Society in 1851, and was soon after elected a mem-

ber of the Council, and was for more than three years a Vice-President. He was an amiable man of retired habits. He was a good Sanskrit scholar, and his loss is much to be lamented by the members of the Society.

The Secretary then read a paper on the Ethnology of India, by J. B. Davis, Esq. M. D., of which the following is an abstract.

Our author begins his paper by saying that the Ethnology of India is no new subject, but is of great interest, and is at the present time attracting considerable attention. The study of it may be said to date from the earliest advent of western science to the shores of the Ganges; and it is considered to have made great progress, for, upon the foundation then laid, a comprehensive hypothesis has been built, and is now all but universally received, which is almost as vast as the old world, and probably embraces nearly as many races of man as the ancients were acquainted with.

Sir William Jones, in his third discourse, said: "The Sanscrit language, whatever be its antiquity, is of a wonderful structure; more perfect than the Greek, more copious than the Latin, and more exquisitely refined than either; yet bearing to both of them a stronger affinity both in the roots of verbs and in the forms of grammar, than could possibly have been produced by accident; so strong indeed, that no philologer could examine all three, without believing them to have sprung from some common source, which, perhaps, no longer exists."—*Ariana Antiqua*, p. 122 &c.

Our author thinks it difficult to conceive of the argument respecting the Arian hypothesis as other than a suppositional and unstable foundation for the Indo-European hypothesis, the affinity of words being the strongest and surest material that enters into the composition. A competent philological authority has already said respecting one great branch of it:—"If the current views concerning what is called the eastern origin of the so-called Indo-Europeans are correct, they are so by accident; for they rest upon an amount of assumption far greater than that which the nature of the question either requires or allows."—Dr. R. G. Latham. *Prickard's eastern origin of the Celtic Nations*. Preface, p. vii.

However, assuming this foundation to be substantially true, an immense amount of learning has been expended in investigating

the different subjects of comparative philology, in order to show the descent of a great number of words of various languages from a Sanscritic source—from which it is inferred that the very varied races of people who spoke or still speak them are all of Arian origin. So that at length, the Indo-European hypothesis embraces as of one family the races of Europe and of India, *i. e.* the Brahmins, Kshatriyas and Vaisyas, with many intervening links. With recipients of this hypothesis all contradictory facts are at once silenced by the very position we have already quoted from Sir William Jones, that the languages “cannot be examined without believing them to have sprung from some common source.” The conclusion alluded to is arrived at by transposing the argument from the subject of language to human races; if the languages had a common source, the people who have spoken, or who now speak them, are all intimately allied. The fact of the connection of or affinity in the languages is to a certain extent undeniable, but probably it admits of a rational and consistent explanation very different from the received one.

We do not venture to go into the question of the truth of so universally admitted a hypothesis as that of the Indo-European, for we are fully aware that great numbers of able and learned men in India are engaged in working out its details, and are daily discovering what are considered firm proofs of its validity. We shall limit ourselves to the suggestion, whether we can look with so much confidence upon the truth of this grand hypothesis, if there be good reason to conclude that the human race, instead of having had its cradle in Armenia, in any portion of Central Asia or elsewhere, and being left to its own inadequate struggles to diffuse itself all over the habitable globe, is, in the main, an aggregate of families formed by the hand of the Creator, in every different locality in which it is found, and each constituted by that wise Providence for the climate and productions with which it is surrounded.

A very distinguished physiologist, the favourite disciple of Blumenbach, Professor K. A. Rudolphi, long since pointed out that “a single human pair was certainly not fitted to people the whole earth. A wild animal or a disease equally might have defeated the object. This is not the way in which nature goes to work. In so important an affair as the peopling of the earth by men, she could not possibly

have risked all to so hazardous a chance."—*Beyträge zur Anthropologie* S. 147.

And the celebrated zoologist, Professor Louis Agassiz, has said : "We maintained, that, like all other organized beings, mankind cannot have originated in single individuals, but must have been created in that numeric harmony which is characteristic of each species ; men must have originated in nations, as the bees have originated in swarms, and as the different social plants have at first covered the extensive tracts over which they naturally spread."—*The Diversity of origin of the Human Races*, p. 128.

Our author then proceeds to quote Sir Samuel Baker's paper on the races of the Nile basin. *Trans. Ethnological Soc.* V. p. 237.

He gives a detailed account of the low mental and moral state of the inhabitants of the district, and concludes by enquiring whether we can venture to date from one common origin, and claim this degraded creature as "*a man and a brother.*"

The question of colour next occupies our attention. Although the languages of the Indian and European races may be traceable to a Sanscrit source, yet one great race is black of various shades, and the other white of different shades, and they differ to an equal extent in their capabilities of intellectual development. To this it has been boldly replied that "no physiologist will insist upon difference of colour as an argument against the common origin of the European and Asiatic races." In proof of this, many instances of fair and handsome families of Asiatics are cited. Reference is then made to the Scriptural testimony enunciated in the words, "Can the Ethiopian change his skin or the leopard his spots?" In support of this view, our author mentions the facts that the descendants of the Dutch colonists in South Africa are as fair as ever, while the descendants of the negroes who settled 80 years ago in Nova Scotia are still the same negroes that they were at first ; unfortunately with all the same intellectual and moral defects.

Our author then proceeds to state it to be his opinion that craniology affords a much more firm basis for ethnology than philology possibly can. If Europeans and Hindoos be of the same family, why cannot the former migrate to and live in India ? How is it that the people of India are celebrated for the smallness of their heads,

while the inhabitants of Europe have large heads? The magnitude of the brain among Europeans is too well known to need any proof. How are these facts to be reconciled, if both these people are the direct descendants of one and the same remote ancestry? • They could only be reconciled by unwarrantable suppositions which are contrary to knowledge; for, in truth, they are totally irreconcilable. Since the days of Cæmpen and Blumenbach, the craniology of the human race has taken the first position in anthropology, man being preëminent among all other animals in the preponderant development of his cerebral system which gives him his place in nature, and is the centre of all his peculiarities; it is, therefore, the best interpreter of those essential differences that reign between the several races of men. The collection of the materials for the study of the craniology of India may be said to have yet to be commenced, although great numbers of educated men have abundant opportunities for such collection. In all other regions of the globe, craniology has been made the proper basis for anthropological researches. An able writer in the "Calcutta Review" for June 1856, pointed out that this great branch of the subject is still open for inquiry, and said that "a circle of Medical officers, say at Ootacamund, Ahmedabad (in Guzerat), Cuttack, Manbhoom, Beerbhoom, Hazareebagh, Bhagulpore, Darjeeling, Nipal, Mymensing, Assam, Sylhet, Cachar, Tipperah and Chittagong, acting in concert, might unravel the inquiry of the skulls in a twelvemonth." It is to be hoped that the circular printed in the last number of the "Annals," No. XXI. p. 394, will excite attention to this most important matter, and that the reproach will not much longer remain, of an entire want of craniological material for the anthropology of India. The author has already offered aid in carrying out such a project, and hopes that it will be eminently successful.

It is trusted that the cultivators of Indian philology will hail with satisfaction the conjunction of the efforts of those who pursue physical researches with their own, as there is much diversity of opinion upon some primary points of their inquiry which may be dissipated by the latter. It is hitherto an unsettled question whether the Tamulian tribes of Peninsular India ought to be regarded as aboriginal; some of the most learned and most diligent investigators consider them as such, and ally them closely with the Scythic or



Turanian tribes of the north. It is not at all too much to say that this question, with a number of others, may be satisfactorily illustrated by an adequate examination of their craniology, whenever the means for such shall be procured. Whether this hope may be realized is after all doubtful, when we look to another line of philological inquiry. It is an admitted fact among philologists that the division of mankind designated by them "Syro-Arabian" is physically identical with the Aryan section; still the two cannot be allied, because the languages of the two families utterly sunder them. This proves the false position that has come to be assigned to philological affinities and diversities; they are erroneously assumed to be of higher import than sameness or discrepancy of organization. So that if Indian Ethnologists are not prepared to allow the position here assumed for craniological researches, still it must be admitted that, regarding them merely as auxiliary to those based upon languages, they are of the utmost value and utility.

Mr. W. Blanford said :—

It appears to me that Mr. Davis falls into precisely the error against which he inveighs. He objects to the affinities of the European and Hindu races being decided by the question of language alone, yet he attempts to decide it by the size of their skulls. At least one half of the errors which exist in natural history classifications, are due to the vicious system, a system which cannot be too strongly reprehended, of depending upon some one peculiarity or some one organ alone, without regard to others. I believe questions of race are not to be decided by crania alone, and if so decided, the decisions will, I believe, be of but small value.

Mr. Davies does not appear to me either to have answered the strong arguments which exist in favour of the unity of races, nor to have brought forward any but old and well-worn arguments on the other side. Some of the latter I am surprised to listen to. The fact that negroes have bred truly for 80 years in Nova Scotia, simply shews that three generations of children may resemble their parents. On the other hand, the assertion that no change ever takes place in the intellectual faculties of a race, appears opposed to the history of some of the races now inhabiting Western Europe, which 3000 years ago were savages, little, if at all superior to the tribes of Central Africa at the present day.

Dr. J. Anderson said, leaving out of consideration the opinions which Dr. Davis had expressed on the much disputed theory of the origin of the so-called Arian races of India, he believed, that the chief object of the paper, now before the Society, was to direct the attention of Ethnologists in India to the importance of physical characters as a means of determining the affinities of race. Dr. Davis, from the whole tenor of his communication, is apparently impressed with the idea that, in India, philology has been studied to the exclusion nearly of the physical aspect of the enquiry, and the aim of his paper evidently is, to try and excite in the minds of Indian philologists an interest in the physical facts of ethnology. To this extent I agree with Dr. Davis, as there cannot be a doubt that physical ethnology has been much neglected in this country. Under the circumstances, I think we are indebted to Dr. Davis for calling our attention to the subject, and I have therefore much pleasure in proposing that we should award him a vote of thanks.

With regard to the facts which Dr. Davis has adduced in support of the importance of physical ethnology, and the stress which he seemingly places on the mere capacity of the cranium as a rare character, I think that many more telling facts might have been selected, and that Dr. Davis, in placing the capacity of the cranium so prominently forward, to the exclusion of any mention of its general form and relative proportions, has much understated the question at issue,—the comparative importance of philology and craniology in Ethnological enquiries.

What physical ethnology aims at, in making the cranium the subject of its enquiries, is to attain, by the accurate measurements of a large series of the crania of a race, an accurate conception of the general form and relative proportions and capacity of the skull, and having satisfactorily determined these points in a number of races, to proceed to classify them according to the similarities of their crania. However, I am certain Dr. Davis is quite as impressed with the importance of researches of this kind as we are, and I only regret that he did not state the question more strongly. I have much pleasure in proposing the vote of thanks.

Dr. Partridge seconded the proposition.

The Secretary then read the following paper.

*Notes in reference to the question of the origin of the Aboriginal tribes of India.—By Emil Schlagintweit, corresponding member to the Asiatic Society of Bengal, &c.*

The Hon'ble G. Campbell, in his so highly valuable motion respecting the aboriginal tribes of India, argues the fact that, though some resemblance is existing between the languages of the broken aboriginal tribes of India and the Tibetan\* races, yet both groups are widely differing from each other in bodily appearance. It cannot be denied, that there exist many an expression in the aboriginal languages as well as in the Dravidian group which are very akin to Tibetan; more important it would be to be able to point out some striking analogies in the grammatical structure; for such comparisons, however, the measures recommended by Hon'ble G. Campbell, must supply us with the necessary materials in future. Greater analogies still can be pointed out between Tibetan and the languages of some of the tribes of the Indo-Chinese Peninsula; also here, however, the difference in the general aspect rather seems to intimate, that from mutual contact elements, finally foreign, have crept into languages, the bearers of which stand but in a very loose ethnological connection with the race from whom they have borrowed.† When looking out for similarities in manners, we find the Kakhyen tribe of northern Bérma wearing the sword in the same strange way, by means of a wooden ring to which the sheath is fastened with ropes, as it is the custom amongst the Lingphos in Assam. The Kakhyens, moreover, have hereditary chiefs, and the high dignity of a ruler may even be held by a child, should it happen the government devolves upon him in time of in-

\* I have adopted the spelling of "Tibetan" instead of "Thibetan" in conformity with Csoma Korasi, Foucaux, Hodgson, Jäeschke, Schiefner, Schmidt, &c. The word Tibet has resulted from the combination of the two Tibetan words *Thub* and *Phod* both meaning "to be able." A king of the 7th century is said to have at the first made use of this name; at present, however *Bhod-qul*, "territory of the Bhod," is the only name given by the inhabitants to the country. For further names see my "Kings of Tibet," Munich, Royal Bavarian Academy Index, s. v.

† This becomes evident by the interesting papers of Capt. T. R. Logan, "Ethnology of the Indian Pacific Islands," Journal of the Indian Archipelago, 1857, where numerous vocabularies are to be found; the coincidence is most remarkable in many instances; and Capt. Logan by the detailed analysis of these vast materials has to a great degree contributed to a better valuation of the variations. See also Schiefner *Tibetische Studien*, *Mélanges Asiatiques*, vol I; St. Petersburg, 1851, and my "Kings of Tibet," p. 6.

fancy; this practice reminds us of the system of incarnate priests in Tibet, where the seat of the Dalai Lama is taken, as a rule, by a mere child. It must be remarked, however, that the Tibetans distinguish the Kakhyens as a peculiar race, differing in language from that of the Shans and Bèrmese.\*

But as regards definite conclusion, the comparison of the bodily appearance was duly pointed out as being of special importance. For the races in consideration here, this is the more unavoidable, since the linguistic affinity can be reduced in some degree to the influence of intermixture. Tibetans may have settled, by way of victory,† in parts of the Indo-Chinese Peninsula. But either they were few in number, or their reign was of short duration, as they have not left traces in the bodily proportions of these tribes.

In reference to general physical appearance, I wish to draw the attention to some striking differences shown by the face of a Tibetan when compared with an aboriginal of India; these differences have become evident to me by the analysis of the casts‡ taken from living individuals by my brothers during their travels. If we take a Tibetan, Nos. 197—228 of the Catalogue, or a Gorkha of Nepal, as *e. g.* No. 25, and look at his profile, we find as a rule that the depression of the nose is so great that the curve of the eye is more prominent than the saddle, the upper beginning of the nose. Amongst the aboriginal tribes of Central India, such as the Gonds and Bhils, this depression is not met with, though the orbits are very prominent; the lower end of the nose is very flat and broad (see Nos. 117—182 of the Catalogue). In this respect the aborigines are not very greatly distinguished from the Aryan race, in which the eyes are always lower than the nose-line, but there is another peculiarity which I consider very typical for the race of the aborigines. Take a cast of an aboriginal, *e. g.* No. 133 (Gond), No. 139 (Bhil), No. 138 (Kol), and unite by lines;—

\* See Dr. Williams's papers on the question of British trade with China via Burma, in the Asiatic Society's Journal, 1864.

† Such is the opinion of Logan; I must, however, add that in my studies of Tibetan historical books I have not found any written record relating to conquests so far south-east.

‡ A complete set of these casts, comprising 275 heads, 80 hands and 7 feet, has been put up also in your rich Museum by the liberality of the Government.

- 1st. The orbits at their most prominent part.
- 2nd. The outer corners of the eyes.
- 3d. The wings of the nose.
- 4th. The corners of the mouth.

These lines will be found far from being parallel; the angles are in some cases even very sharp. I suppose that the ugliness of these races is particularly due to the great deviation of these lines from parallelism; for with the Brahmans, *e. g.* No. 1, and the Europeans in general, we find a regularity very great, just for these lines. Also the face of a Tibetan is far from being as irregular as that of an aboriginal, but one is greatly reminded of an aboriginal, if the same experiment is made with the facial cast of a Negro, *e. g.* No. 173.\*

I here limit myself to these few remarks which I shall be happy to see carried on to a larger scale, in the volume on the Ethnography of India, which forms part 8th of the "Results of a scientific mission to India and High Asia." Outlines of the entire series of casts, both in full and in profile, shall be given, as well as of the skulls and skeletons (83 in number), together with the numerous bodily measurements.†

As to facial expression of race, my experience has shown me that plastic casts offer a wider field of inquiry than mere photographs.

The process by which the casts are taken is a most simple one;‡ only plaster of Paris, about 5-7 lbs. for each face, is wanted. The individual in question lies down on the ground, a writhed handkerchief is bound behind the ears to prevent the plaster from running down to the ground. Two paper-cornets, moist at the ends, for preventing irritation and sneezing, are put into the nose for allowing free breathing. Before the plaster is laid over the

\* When skulls are compared in all their directions, analogous instances become evident and even more apparent still.

† Some of these measurements, which exceed the sum of 400, have been given in my "Buddhism in Tibet," Chapter XIV. For an analysis of the skulls brought home by my brothers, see Professor Volker's "Chronologische Mittheilungen, No. 7 of the Memoirs published by the German Anthropological Society, founded 1865. This series contains specimens of the following Indian castes and tribes: Rajputs, Lepchas, Ganges-Mussalmans, Thakurs, Sikhs, Bhots of Tibet, Kashmiris, Bhils, Gonds, Kols, Nagas, Khassias, Singalese, Gorkhas, Himalaya Bhots, Brahmans, Bais, Sudras.

‡ This series comprises 27 individuals; viz. Herbes, Rifs, Maures, Sus, Zuariks, Negros, African Jews. The heads as well as the facial casts have been as usually reproduced in metal, and are supplied by John Amb. Barth at Leipzig, at the price of £6 for an entire head (face and occiput).

face, which is done by means of a spoon, the face is to be carefully smeared over with oil or clarified butter, in order not to draw up with the plaster the hairs from the head; the beard, particularly, is to be preserved by stiff pomade of some kind. Our brother Edward, a Bavarian officer lately killed in the battle of Kissingen, succeeded, when in Morocco, in making casts of the back of the head also. For this purpose he found it of great use to cover the hair with thin oiled muslin. The back of the head was made first, then the borders were flattened with a knife, and all duly oiled; the head was placed again in this part of the mould for making the face and part of the breast; thus he obtained a true copy of the head. About 15 pounds of plaster are wanted for an entire head and part of the breast.

Dr. Anderson said that he felt quite uncertain as to what was attempted to be proved in the paper just read. If the object was to detect a similarity of race by the comparison of characters derived solely from the external face, he dissented entirely from the adoption of any such system in Ethnological research. The facial characters, when taken by themselves, as M. Schlagintweit has done from casts, which give not the slightest inkling of the form of the cranium, can lead to no very sound generalization in Ethnology, and indeed the more we restrict ourselves to one character as our guide, in proportion will be our liability to increase in error.

Believing that much weight cannot be attached to facial casts as an aid to Ethnological study, I commenced three years ago the formation of a series of life busts, to illustrate in the Indian Museum the external characters of the head and face of the various Indian races. The busts were taken from life, and the plan I adopted, appears to differ little from that which Mr. Schlagintweit has lately followed. It is this:—I make the subject lie down on a charpoy, and support his shoulder and head with a couple of pillows, over which a loose cloth is laid and tucked in round the head, neck and shoulders, to prevent the plaster spreading too much when it is poured on. Before making the subject lie down, I first thoroughly anoint his face, neck and shoulders and chest with oil, and his beard, moustache, eyelids, eyebrows and the hair of his head with butter, which should be laid on unsparingly on these parts, to prevent their adhering to the plaster. When the anointing has been

completed, I place a tube on to each nostril, to allow of respiration when the face is covered with plaster, and I plug the ears. He is then made to recline on the charpoy in the manner I have indicated, and a well oiled cord is laid along the neck from the shoulder in front of the ears and over the top of the forehead to the shoulder on the other side, the ends are allowed to hang down the shoulders a little way. The eyes being gently but firmly closed and the quills in the nostrils, the plaster is poured over the face, neck and as much of the head as can be reached without interfering in the least with the position of the patient ; when the plaster is beginning to set, the ends of the string which passes from shoulder to shoulder are laid hold of by the two ends and pulled towards each other, thus separating the head and facial portions of the cast from one another ; when the latter has hardened it is carefully removed and the man can then open his eyes and breathe naturally. With the former portion still remaining on the head and part of the shoulders, he is made to sit up, and the back of the head and neck ; is well smeared with butter, and another well oiled string is placed along the posterior margin of the still adherent portion of the cast. The plaster is then poured on to the back of the head and neck ; and when it has commenced to harden, it is separated from the remaining portion of the first cast by pulling the ends of the string towards each other. These two pieces are then removed, and the three are found to fit to each other in the most perfect manner. The process is thus completed ; I have found it attended with little or no difficulty, and as I have manipulated on a number of hill tribes who are generally difficult people to manage, I fully expect to be able, through time, to have life busts of all the accessible Indian races.

These busts will prove of considerable value when crania cannot be obtained, and there is no country in the world in which the craniologist finds greater difficulty in obtaining materials for study than India, where the inhabitants either burn their dead or regard their remains with superstitions awe.

Dr. Partridge, as Secretary to the Falconer Memorial Committee, presented a marble bust of the late Dr. H. Falconer to the Asiatic Society. He stated that 44 members of the Society had subscribed Rs. 20 each for the purchase of the bust, and two subscriptions have yet to be realized, but even then a balance of Rs. 110 would be still due

to meet the excess of expenditure over receipts. He therefore appealed to the members for additional subscriptions which he hoped would suffice, not only to meet the balance due, but also enable the Society to purchase a suitable pedestal.

#### LIBRARY.

The following additions were made to the Library since the Meeting held in July last :—

#### PRESENTATIONS.

*Annales Musei Botanici Lugduno-Batavi*, by F. A. Guil. Miquel. Tome II. Fasc. VI. to X.—THE AUTHOR.

*Actes De La Société D'Ethnographie*, 5th Avril, 1867.—THE SOCIÉTÉ D'ETHNOGRAPHIE.

Three copies of Memoranda on the Solar Eclipse of 18th July, 1860, and Data to aid in the observation of the Solar Eclipse of 17th August, 1868.—THE SURVEYOR GENERAL OF INDIA.

Annual Report on the condition and management of the jails in the North-Western Provinces for 1866.—THE GOVERNMENT OF THE NORTH-WESTERN PROVINCES.

*Mémoire de la Société Impériale des Sciences Naturelles de Cherbourg*, Vols. XI. and XII.—THE SOCIÉTÉ.

Six copies of Memoranda on the Eclipse of August, 1868, by Major F. Tenant :—THE AUTHOR.

Two copies of Catalogue of the Mollusca in the collection of the Government Central Museum, Madras.—CAPTAIN J. MITCHELL.

Report of the Revenue survey operations of the Lower Provinces for 1865-66.—THE GOVERNMENT OF BENGAL.

*Memoirs of the Geological Survey of India*, Vol. VI. pt. I. Mr. Blanford's Geology of Cutch.—THE GOVERNMENT OF INDIA.

*Bulletin de la Société de Géographie*, Mai, 1867.—THE GEOGRAPHICAL SOCIETY OF PARIS.

Four copies of Extract from the Proceedings of the Government of Bombay in the General Department, dated 27th June, 1867.—THE GOVERNMENT OF BENGAL.

*Vividha Jnán Vistára*, No. I.—THE EDITOR.

The Coal resources and Productions of India, by Dr. T. Oldham.—THE GOVERNMENT OF INDIA.



A History of Orissa in Bengali, by Shib Chunder Shome.—THE AUTHOR.

The Journal of the Chemical Society, April, May, and June, 1867.—THE CHEMICAL SOCIETY OF LONDON.

Reise der Oesterreichischen Fregatte Novara um die Erde in den Jahren 1857, 1858, 1859. Linguistischer Theil, by Dr. F. Muller :—K. K. MINISTERIUM DES INNERN ZU WIEN.

Proceedings of the Royal Geographical Society of London, Vol. XI. No. II.—THE ROYAL GEOGRAPHICAL SOCIETY OF LONDON.

Proceedings of the Academy of Natural Sciences of Philadelphia. January to December, 1866.—THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA.

Journal of the Academy of Natural Sciences of Philadelphia, Vol. VI. pt. I.—THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA.

Brief sketch of the gold, silver and copper coinage of Mysore by Lieut. H. P. Hawkes.—COLONEL C. S. GUTHRIE.

Annals of Indian Administration, pts. I. and II. Vol. XI.—THE GOVERNMENT OF BENGAL.

Annual report upon Vaccination in the North-Western Provinces.—THE GOVERNMENT OF THE NORTH-WESTERN PROVINCES.

ভূপ্তির অর্থ কি? translated by Nandalala Dhol.—THE TRANSLATOR.

#### PURCHASE.

The Indian Medical Gazette, Vol. II. No. 8.

The Annals of Indian Medical Science. No. XXII.

The Annals and Magazine of Natural History, June, 1867.

Revue des Deux Mondes, May, and 1st June, 1867.

Comptes Rendus, Nos. 18, 19, 20 and 21.

Le Livre de L'Agriculture D'Ibn-Al-Awam by J. J. Clement Mullet, Vol. II. pts. 1 and 2.

Catalogue Général de la Librairie Française, Livr. 4.

Journal des Savants, Mai 1867.

#### EXCHANGE.

The Athenæum, May 1867.



1867.]

*Proceedings of the Asiatic Society.*

ABSTRACT STATEMENT  
OF  
RECEIPTS AND DISBURSEMENTS  
OF THE  
ASIATIC SOCIETY,  
FOR  
THE YEAR 1866.

## STATEMENT

*Abstract of the Cash Account*

| RECEIPTS.                                                                                                                              |            | 1866.      | 1865.        |
|----------------------------------------------------------------------------------------------------------------------------------------|------------|------------|--------------|
| ADMISSION FEES.                                                                                                                        |            |            |              |
| Received from New Members, Rs.                                                                                                         | 1,280 0 0  | 1,280 0 0  | 928 0 0      |
| CONTRIBUTIONS.                                                                                                                         |            |            |              |
| Received from Members, ...                                                                                                             | 8,676 0 0  | 8,676 0 0  | 9,445 0 0    |
| JOURNAL.                                                                                                                               |            |            |              |
| Sale proceeds of, and Subscription to the Journal of the Asiatic Society, ...                                                          | 1,285 10 0 |            |              |
| Refund of Postage Stamps, ...                                                                                                          | 31 10 0    |            |              |
| Ditto of Packing Charges, ...                                                                                                          | 3 7 0      |            |              |
| Ditto of the amount from the Baptist Mission Press, overpaid in Bill No. 13438, being the cost of 6 Copies of Journal No IV. 1864, ... | 6 6 0      | 1,327 1 0  | 758 1 0      |
| LIBRARY.                                                                                                                               |            |            |              |
| Sale proceeds of Books, ...                                                                                                            | 586 0 9    |            |              |
| Refund of Freight, ...                                                                                                                 | 12 2 0     |            |              |
| Ditto of the amount paid for a copy Owen's Comparative Anatomy, Vol. I., ...                                                           | 12 0 0     | 610 2 9    | 193 15 0     |
| MUSEUM.                                                                                                                                |            |            |              |
| Received from the General Treasury at 500 Rs. per month, from December, 1865 to April, 1866,                                           | 2,500      |            |              |
| Savings of salary, ...                                                                                                                 | 41         |            |              |
| Refund in part of the Contingent Expenses, ...                                                                                         | 2 6 0      |            |              |
| Ditto of the amount paid from the Contingent Account in March and April to Harry, Taxidermist,                                         | 40 0 0     |            |              |
| Ditto in part of the amount paid to Dr. J. Anderson for Medicine by Messrs. Bathgate and Co.'s bill on the 22nd May, 1866, ...         | 5 13 0     | 2,0        | 3 3 6,037 13 |
| SECRETARY'S OFFICE.                                                                                                                    |            |            |              |
| Refund of Postage Stamps, ...                                                                                                          | 17 10 0    |            |              |
| Ditto of Packing Charges, ...                                                                                                          | 0 7 0      |            |              |
| Savings, ...                                                                                                                           | 4 0 0      |            |              |
| Discount on Postage Stamps, ...                                                                                                        | 0 7 0      |            |              |
| Refund of Freight, ...                                                                                                                 | 0 5 0      | 22 13 0    | 34 7 0       |
| General Establishment,                                                                                                                 |            | 17 1 0     | 1 14 9       |
| Carried over, Rs.                                                                                                                      |            | 14,522 5 0 |              |

No. 1.

*of the Asiatic Society for 1866.*

| DISBURSEMENTS.                                                     |     |            | 1866.       | 1865.     |
|--------------------------------------------------------------------|-----|------------|-------------|-----------|
| JOURNAL.                                                           |     |            |             |           |
| Freight, ..                                                        | Rs. | 113 11 0   |             |           |
| Printing Charges, ...                                              |     | 1,729 9 0  |             |           |
| Commission on Sale of Books, ...                                   |     | 16 2 1     |             |           |
| Purchase of Postage Stamps, ...                                    |     | 194 10 0   |             |           |
| Packing Charges, ...                                               |     | 28 4 0     |             |           |
| Lithographing and Engraving<br>Charges, &c., ...                   |     | 705 4 3    |             |           |
| Purchase of a copy of Journal<br>Supplementary Number, Vol. 15,    |     | 1 0 0      |             |           |
| Petty Charges, ...                                                 |     | 11 7 6     |             |           |
|                                                                    |     |            | 2,799 15 10 | 3,272 4 3 |
| LIBRARY.                                                           |     |            |             |           |
| Salary of the Librarian, ...                                       |     | 840 0 0    |             |           |
| Establishment, ...                                                 |     | 84 0 0     |             |           |
| Salary for preparing a revised<br>Catalogue, ...                   |     | 500 0 0    |             |           |
| Purchase of Books, ...                                             |     | 375 3 3    |             |           |
| Ditto of a Standford Library Map<br>of Asia on roller, ...         |     | 35 0 0     |             |           |
| Ditto of Album of Photographs of<br>Sháhaná, ...                   |     | 125 15 6   |             |           |
| Mounting 4 Sheets of german Map<br>of Asia on roller, ..           |     | 5 0 0      |             |           |
| Purchase of a set of Photographs<br>of Cashmire, ...               |     | 42 0 0     |             |           |
| Ditto of a set of ditto, ...                                       |     | 140 0 0    |             |           |
| Ditto of 27 Photograph Views, ...                                  |     | 69 0 0     |             |           |
| Book-Binding, ...                                                  |     | 263 14 0   |             |           |
| Landing Charges, ...                                               |     | 14 10 6    |             |           |
| Commission on Sale of Books, ...                                   |     | 40 13 2    |             |           |
| A Blank Book, ...                                                  |     | 5 0 0      |             |           |
| Freight, ...                                                       |     | 3 4 0      |             |           |
| Salary of Office Punkha-man, ...                                   |     | 40 0 0     |             |           |
| Ditto for preparing List of the<br>Duplicate Books, ...            |     | 40 0 0     |             |           |
| Ditto of ticca Duftory, ...                                        |     | 12 4 3     |             |           |
| 6 Dusters for cleaning books, ...                                  |     | 1 12 0     |             |           |
| Prepairing two Teak wood Book<br>cases, ...                        |     | 682 8 0    |             |           |
| Purchase of Custom Stamps, ...                                     |     | 3 0 0      |             |           |
| Petty Charges, ...                                                 |     | 23 4 3     |             |           |
| Subscription to the Indian Medi-<br>cal Gazette, ...               |     | 15 0 0     |             |           |
|                                                                    |     |            |             | 2 576 0 0 |
|                                                                    |     | 3,361 8 11 |             |           |
| Purchase of Books through Messrs.<br>Williams and Norgate, London, |     | 1,889 1 10 |             |           |
|                                                                    |     |            | 5,250 10 9  |           |
| Carried over, Rs.                                                  |     |            | 8,050 10 7  |           |

## RECEIPTS.

Brought over, Rs. 14,522 5 0

## VESTED FUND.

Sale proceeds of Government

Securities, ... 7,500 0 0

Interest on ditto, ... 255 0 6

Premium on ditto, ... 387 8 0

8,142 8 6 337 8 0

## COIN FUND.

Sale proceeds Silver Coins, ... 5 0 0

5 0 0 236 15 6

## BABU POORNO CHUNDER BYSACK.

Refund in part of the amount

advanced for Contingent Ex-

penses, ... 1,648 8 6

1,648 8 6 762 15 3

## MESSRS. WILLIAMS AND NORGATE.

Sale proceeds of Books on their

account, ... 4 4 0

4 4 0

## MAJOR-GENL. CUNNINGHAM.

Refund of Packing Charges, ... 0 6 6

0 6 6

## J. H. BATTEN, ESQ.

Refund of the amount advanced, ... 2 9 0

2 9 0

## HARRY, TAXIDERMIST.

Refund of the amount advanced, ... 103 0 0

103 0 0

## CAPTAIN M. W. CARR.

Received from him in Deposit, ... 3 12 0

3 12 0

## MAJOR A. S. ALLAN.

Received from him in Deposit, ... 7 4 0

7 4 0

## JAMES BEAMES, ESQ.

Received from him in Deposit, ... 0 12 0

0 12 0

## CAPTAIN C. MACGREGOR.

Refund of Banghy Expenses and

Postage Stamps for sending

Library Books, ... 5 3 0

5 3 0

## REV. H. A. JESCHKE.

Sale proceeds of a Copy of Tibetan

Grammar on his account, ... 1 0 0

1 0 0

## GOVERNMENT NORTH WESTERN PROVINCES.

Refund of freight for sending

Journal and Proceedings for

1865, ... 16 5 0

16 5 0

## CAPTAIN H. H. G. AUSTEN.

Refund of the amount paid for

sending Library Books, ... 15 10 0

15 10 0

Carried over, Rs. 24,478 7 6

## DISBURSEMENTS.

Brought over, Rs. 8,050 10 7

## MUSEUM.

|                                    |       |    |    |       |    |   |           |
|------------------------------------|-------|----|----|-------|----|---|-----------|
| Salary of the Sub-Curator, ...     | 500   | 0  | 0  |       |    |   |           |
| Establishment, ...                 | 320   | 10 | 6  |       |    |   |           |
| Extra Taxidermist's Salary and     |       |    |    |       |    |   |           |
| Contingent Pay, ...                | 1,742 | 13 | 11 |       |    |   |           |
| Contingent Expenses, ...           | 2,596 | 7  | 7  |       |    |   |           |
| Advertising Charges, ...           | 3     | 12 | 0  |       |    |   |           |
| Paid Messrs Higgs and Haldar,      |       |    |    |       |    |   |           |
| for white Satin Painting, to       |       |    |    |       |    |   |           |
| Museum Cases, ...                  | 478   | 14 | 9  |       |    |   |           |
| Ditto ditto for Stands, Railing    |       |    |    |       |    |   |           |
| and Painting, ...                  | 363   | 14 | 6  |       |    |   |           |
| Ditto ditto for making an animal   |       |    |    |       |    |   |           |
| stand, and taking up and re-set-   |       |    |    |       |    |   |           |
| ting in brick, &c. &c., ...        | 78    | 0  | 0  |       |    |   |           |
| Ditto ditto for Asphalting two     |       |    |    |       |    |   |           |
| rooms and renewing glasses to      |       |    |    |       |    |   |           |
| the Almirah and Sash door, &c.,    | 159   | 10 | 0  |       |    |   |           |
| Printing 500 Copies of Circular, . | 15    | 0  | 0  |       |    |   |           |
| Engraving 3 sets of Figures on     |       |    |    |       |    |   |           |
| Brass with Handle for branding     |       |    |    |       |    |   |           |
| the specimens of the Museum,       | 13    | 8  | 0  |       |    |   |           |
|                                    |       |    |    | 6,272 | 11 | 3 | 6,468 3 6 |

## SECRETARY'S.

|                                   |       |   |   |       |   |   |             |
|-----------------------------------|-------|---|---|-------|---|---|-------------|
| General Establishment, ...        | 403   | 8 | 0 |       |   |   |             |
| Secretary's Office Establishment, | 1,068 | 0 | 0 |       |   |   |             |
| Purchase of Postage Stamps, ...   | 128   | 7 | 0 |       |   |   |             |
| Stationery, ...                   | 139   | 5 | 6 |       |   |   |             |
| Purchase of Blank Books, ...      | 7     | 4 | 0 |       |   |   |             |
| Insufficient Postage, ...         | 6     | 3 | 3 |       |   |   |             |
| Printing Charges, ...             | 12    | 0 | 0 |       |   |   |             |
| Repairing a Tin Almirah, ...      | 8     | 0 | 0 |       |   |   |             |
| Petty Charges, ...                | 11    | 6 | 6 |       |   |   |             |
|                                   |       |   |   | 1,784 | 2 | 3 | 2,349 13 3. |

## VESTED FUND.

|                                  |       |    |    |       |   |    |        |
|----------------------------------|-------|----|----|-------|---|----|--------|
| Purchase of 5½ per cent. Govern- |       |    |    |       |   |    |        |
| ment Securities, ...             | 3,000 | 0  | 0  |       |   |    |        |
| Interest on ditto, ...           | 13    | 12 | 0  |       |   |    |        |
| Premium on ditto, ...            | 232   | 8  | 0  |       |   |    |        |
| Commission on ditto, ...         | 22    | 8  | 0  |       |   |    |        |
| Brokerage on ditto, ..           | 9     | 6  | 0  |       |   |    |        |
| Commission to the Bank of Bengal |       |    |    |       |   |    |        |
| for drawing Interest on the      |       |    |    |       |   |    |        |
| Government Securities, ...       | 0     | 7  | 10 |       |   |    |        |
| Fee for renewing Government      |       |    |    |       |   |    |        |
| Securities, ...                  | 6     | 0  | 0  |       |   |    |        |
|                                  |       |    |    | 3,284 | 9 | 10 | 0 13 6 |

## COIN FUND.

|                                      |     |   |   |     |   |   |          |
|--------------------------------------|-----|---|---|-----|---|---|----------|
| Purchase of Coins, ...               | 340 | 0 | 3 |     |   |   |          |
| Ditto of a fire-proof Treasure Chest |     |   |   |     |   |   |          |
| with Cooly-hire, ...                 | 133 | 0 | 0 |     |   |   |          |
| Preparing an under Case of ditto     |     |   |   |     |   |   |          |
| with ditto, ...                      | 80  | 0 | 0 |     |   |   |          |
| Cocoanut Oil for cleaning Coins, .   | 0   | 3 | 0 |     |   |   |          |
|                                      |     |   |   | 503 | 3 | 3 | 386 11 9 |

Carried over, Rs. 19,895 5 2

## RECEIPTS,

Brought over, Rs. 24,478 7 6

|                               |       |     |       |
|-------------------------------|-------|-----|-------|
| MOTHOOR MOHUN KUR.            |       |     |       |
| Refund of the amount paid him |       |     |       |
| as advance for preparing two  |       |     |       |
| book cases, ...               | 200   | 0   | 0     |
|                               | <hr/> |     |       |
|                               |       | 200 | 0 0   |
| E. T. ATKINSON, Esq.          |       |     |       |
| Refund of Banghy Expenses and |       |     |       |
| Postage Stamps for sending    |       |     |       |
| Library Books, ...            | 8     | 0   | 0     |
|                               | <hr/> |     |       |
|                               |       | 8   | 0 0   |
|                               |       |     | 3 8 0 |

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Carried over, Rs. 24,686 7 6



## DISBURSEMENTS.

|                                                                                  |       | Brought over, Rs. |   | 19,895 | 5  | 2 |       |    |   |
|----------------------------------------------------------------------------------|-------|-------------------|---|--------|----|---|-------|----|---|
| BUILDING.                                                                        |       |                   |   |        |    |   |       |    |   |
| Assessment, ...                                                                  | 480   | 0                 | 0 |        |    |   |       |    |   |
| Ditto for Lighting, ...                                                          | 96    | 0                 | 0 |        |    |   |       |    |   |
| Repairing, ...                                                                   | 1,858 | 15                | 0 |        |    |   |       |    |   |
| An Iron shed erected in the compound of the Society,                             | 200   | 0                 | 0 |        |    |   |       |    |   |
|                                                                                  |       |                   |   | 2,634  | 15 | 0 | 2,340 | 7  | 6 |
| MISCELLANEOUS.                                                                   |       |                   |   |        |    |   |       |    |   |
| Salary of the Mally,...                                                          | 57    | 0                 | 0 |        |    |   |       |    |   |
| Advertising Charges,                                                             | 6     | 0                 | 0 |        |    |   |       |    |   |
| Meeting Charges, ..                                                              | 179   | 3                 | 6 |        |    |   |       |    |   |
| Purchase of Receipt Stamps,                                                      | 12    | 0                 | 0 |        |    |   |       |    |   |
| Paid 25 per cent. increase of Salaries for 6 months, ...                         | 55    | 11                | 0 |        |    |   |       |    |   |
| Ditto W. H. Johnson, Esq., for a Tea pot Khokan, ...                             | 8     | 0                 | 0 |        |    |   |       |    |   |
| Fee to the Bank of Bengal for Stamping cheques, ...                              | 3     |                   |   |        |    |   |       |    |   |
| Petty Charges, ...                                                               | 41    |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   | 362    | 4  | 9 | 265   | 12 | 3 |
| MUSEUM TRANSFER ACCOUNT.                                                         |       |                   |   |        |    |   |       |    |   |
| Printing 25 Copies of Act of the British Parliament, ...                         | 20    | 0                 | 0 |        |    |   |       |    |   |
|                                                                                  |       |                   |   | 20     | 0  | 0 | 58    | 0  | 0 |
| ETHNOLOGY COMMITTEE.                                                             |       |                   |   |        |    |   |       |    |   |
| Paid Bangly Expenses for sending a parcel of Official Papers, .                  | 0     | 12                | 0 |        |    |   |       |    |   |
| Copying Report forwarded by the Government of Bengal on various Human Races, ... | 10    | 0                 |   |        |    |   |       |    |   |
| A Blank Book for Proceeding, ...                                                 | 2     | 0                 |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   | 13     | 4  | 0 |       |    |   |
| BABU POORNO CHUNDER BYSACK.                                                      |       |                   |   |        |    |   |       |    |   |
| Paid advance on the Contingent Expenses for the Museum, ...                      | 1,445 | 0                 | 0 |        |    |   |       |    |   |
|                                                                                  |       |                   |   | 1,445  | 0  | 0 | 1,045 | 0  | 0 |
| JAMES BEAMES, Esq.                                                               |       |                   |   |        |    |   |       |    |   |
| Paid Postage Stamps for sending Library Books, ...                               | 4     | 1                 | 0 |        |    |   |       |    |   |
|                                                                                  |       |                   |   | 4      | 1  | 0 |       |    |   |
| CAPTAIN MACGREGOR.                                                               |       |                   |   |        |    |   |       |    |   |
| Paid Bangly Expenses and Postage Stamps for sending Library Books,...            | 5     | 3                 | 0 |        |    |   |       |    |   |
|                                                                                  |       |                   |   | 5      | 3  | 0 |       |    |   |
| GOVERNMENT NORTH WESTERN PROVINCES.                                              |       |                   |   |        |    |   |       |    |   |
| Paid Railway Freight for sending Journal and Proceedings, ...                    | 14    | 8                 | 0 |        |    |   |       |    |   |
|                                                                                  |       |                   |   | 14     | 8  | 0 | 16    |    |   |
| CAPTAIN H. H. G. AUSTEN.                                                         |       |                   |   |        |    |   |       |    |   |
| Paid Bangly Expenses for sending Library Books, ...                              | 12    | 0                 | 0 |        |    |   |       |    |   |
|                                                                                  |       |                   |   | 12     | 0  | 0 | 3     | 4  | 0 |
| WILKINS AND NORSGATE.                                                            |       |                   |   |        |    |   |       |    |   |
| Paid freight for Sending their Books, ...                                        | 8     | 0                 | 0 |        |    |   |       |    |   |
|                                                                                  |       |                   |   | 8      | 0  | 0 | 385   | 12 | 0 |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
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|                                                                                  |       |                   |   |        |    |   |       |    |   |
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|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
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|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
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|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
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|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |
|                                                                                  |       |                   |   |        |    |   |       |    |   |

## RECEIPTS.

Brought over, Rs. 24,686 7 6

Carried over, Rs. 24,686 7 6

## DISBURSEMENTS.

Brought over, Rs. 24,414 8 11

## MOTHOOR MOHUN KUR.

|                                                                  |     |   |   |     |     |
|------------------------------------------------------------------|-----|---|---|-----|-----|
| Paid advance for preparing two Book Cases, ...                   | 200 | 0 | 0 |     |     |
| Ditto ditto for an inner case of the New Iron Safe for Coins,... | 45  | 0 | 0 |     |     |
|                                                                  |     |   |   | 245 | 0 0 |

## E. T. ATKINSON, ESQ.

|                                                                       |   |    |   |    |       |
|-----------------------------------------------------------------------|---|----|---|----|-------|
| Paid Bearing Banghy on a parcel of Library Books returned by him, ... | 3 | 0  | 0 |    |       |
| Ditto Banghee and Railway freight for sending Library Books, &c., .   | 9 | 10 | 3 |    |       |
|                                                                       |   |    |   | 12 | 10 3  |
|                                                                       |   |    |   |    | 3 8 0 |

## PROFESSOR G. BUHLER.

|                                                                       |   |   |   |   |     |
|-----------------------------------------------------------------------|---|---|---|---|-----|
| Paid Banghy Expenses for sending MSS. and Library Books to Poona, ... | 9 | 2 | 0 |   |     |
|                                                                       |   |   |   | 9 | 2 0 |

## J. H. R. CARNAC, Esq.

|                                                                 |   |    |   |   |      |
|-----------------------------------------------------------------|---|----|---|---|------|
| Paid Tin Box and Banghy Expenses for sending Library Books, ... | 9 | 10 | 6 |   |      |
|                                                                 |   |    |   | 9 | 10 6 |

## P. CARNEGIE, Esq.

|                                                         |   |   |   |   |     |
|---------------------------------------------------------|---|---|---|---|-----|
| Purchase for him a Copy of Pre-historic man, No. 1, ... | 1 | 0 | 0 |   |     |
|                                                         |   |   |   | 1 | 0 0 |

## COLONEL E. T. DALTON.

|                                                                        |   |    |   |   |      |
|------------------------------------------------------------------------|---|----|---|---|------|
| Paid Banghy Expenses and Postage Stamps for sending Library Books, ... | 8 | 15 | 0 |   |      |
|                                                                        |   |    |   | 8 | 15 0 |

## F. H. COOPER, Esq.

|                                                                                    |   |   |   |   |     |
|------------------------------------------------------------------------------------|---|---|---|---|-----|
| Paid Bearing Banghy, on a parcel of Asiatic Society's Journal returned by him, ... | 2 | 8 | 0 |   |     |
|                                                                                    |   |   |   | 2 | 8 0 |

## ELPHINSTONE INSTITUTION.

|                                                |   |   |   |   |     |
|------------------------------------------------|---|---|---|---|-----|
| Paid Banghy Expenses for sending Journals, ... | 2 | 0 | 0 |   |     |
|                                                |   |   |   | 2 | 0 0 |

## J. H. RAVENSHAW, Esq.

|                                                     |   |    |   |   |      |
|-----------------------------------------------------|---|----|---|---|------|
| Paid Banghy Expenses for sending Library Books, ... | 1 | 13 | 0 |   |      |
|                                                     |   |    |   | 1 | 13 0 |

## DR. J. P. WISE.

|                                                    |   |    |   |   |      |
|----------------------------------------------------|---|----|---|---|------|
| Paid Postage Stamps for sending Library Books, ... | 0 | 12 | 0 |   |      |
|                                                    |   |    |   | 0 | 12 0 |

## H BEVERLY, Esq.

|                                                    |   |    |   |   |      |
|----------------------------------------------------|---|----|---|---|------|
| Paid Postage Stamps for sending Library Books, ... | 0 | 13 | 0 |   |      |
|                                                    |   |    |   | 0 | 13 0 |

Carried over, Rs. 24,708 12 8

*Proceedings of the Asiatic Society.*

## RECEIPTS.

Brought over, Rs 24,686 7 6

|                        |     |   |   |
|------------------------|-----|---|---|
| BALANCE OF 1865.       |     |   |   |
| In the Bank of Bengal, | 817 | 3 | 0 |
| Cash in hand,          | 103 | 2 | 7 |

920 5 7

Rupees, 25,606 13 1

Examined,  
Sd. PROTAP CH. GHOSHE,  
*Asst. Secy.*  
*Asiatic Society Bengal.*

Errors and Omissions Excepted,  
Sd. BUDDINATH BYSACK,  
*Cash Keeper,*  
*Asiatic Society Bengal.*

Examined and found Correct.  
Sd. DAVID WALDIE, } *Auditors.*  
Sd. S. H. ROBINSON, }

## DISBURSEMENTS.

|                                                     |                               |         |                 |
|-----------------------------------------------------|-------------------------------|---------|-----------------|
|                                                     | Brought over, Rs. 24,708 12 8 |         |                 |
| G. E. WARD, Esq.                                    |                               |         |                 |
| Paid Postage Stamps for sending                     |                               |         |                 |
| Library Books, ...                                  | 0 14 0                        |         | 0 14 0          |
| W. IRVIN, Esq.                                      |                               |         |                 |
| Paid Tin box and freight for sending Library Books, | 3 13 3                        |         | 3 13 3          |
| BALANCE.                                            |                               |         |                 |
| In the Bank of Bengal,                              | 830 2 0                       |         |                 |
| Cash in hand, ...                                   | 63 3 2                        |         |                 |
|                                                     |                               | 893 5 2 |                 |
|                                                     |                               |         | Rs. 25,606 13 1 |

Examined,  
Sd. PROTAP CH. GHOSHE,  
Asst. Secy.  
Asiatic Society Bengal.

Errors and Omissions Excepted.  
Sd. BUDDINATH BYSACK,  
Cash Keeper,  
Asiatic Society Bengal.

Examined and found correct.

Sd. DAVID WALDIE, }  
Sd. S. H. ROBINSON, } Auditors.

STATEMENT  
*Abstract of the Cash*

| RECEIPTS.                              |           | 1866.      | 1865.     |
|----------------------------------------|-----------|------------|-----------|
| <b>ORIENTAL PUBLICATIONS.</b>          |           |            |           |
| Received by sale of Bibliotheca        |           |            |           |
| Indica, ..                             | 2,455 0 0 |            |           |
| Ditto by Subscription to ditto, ...    | 33 4 0    |            |           |
| Ditto by sale of White Yajur Veda, ... | 38 0 0    |            |           |
| Refund of Postage Stamps, ...          | 21 6 9    |            |           |
| Ditto of Packing Charges, ...          | 1 1 3     |            |           |
|                                        | <hr/>     | 2,548 12 0 | 1,573 9 9 |
| <b>GOVERNMENT ALLOWANCE.</b>           |           |            |           |
| Received from the General Treas-       |           |            |           |
| ury at 500 Rs. per month, 12           |           |            |           |
| months, ...                            | 6,000 0 0 |            |           |
|                                        | <hr/>     | 6,000 0 0  | 6,000 0 0 |
| <b>VESTED FUND.</b>                    |           |            |           |
| Received Interest on the Govern-       |           |            |           |
| ment Securities from the Bank          |           |            |           |
| of Bengal, ...                         | 442 8 0   |            |           |
|                                        | <hr/>     | 442 8 0    | 412 8 0   |
| <b>CUSTODY OF ORIENTAL WORKS.</b>      |           |            |           |
| Saving of Salary, ...                  | 1 13 9    |            |           |
|                                        | <hr/>     | 1 13 9     | 10 7 9    |
| <b>BABU NOBIN CHUNDER ROY.</b>         |           |            |           |
| Received from him on Deposit, ...      | 2 8 0     |            |           |
|                                        | <hr/>     | 2 8 0      |           |
| <b>C. SESHADRI S'ASTRI.</b>            |           |            |           |
| Received from him on deposit, ...      | 8 11 0    |            |           |
|                                        | <hr/>     | 8 11 0     |           |
| <b>K. ROGHUNATH ROW.</b>               |           |            |           |
| Received from him on deposit, ...      | 22 4 3    |            |           |
|                                        | <hr/>     | 22 4 3     |           |
| <b>KUBI HERA CHUND KANJEE.</b>         |           |            |           |
| Received from him on deposit, ...      | 265 15 0  |            |           |
|                                        | <hr/>     | 265 15 0   |           |
| <b>HOLACUL NARASIMINEAH, Esq.</b>      |           |            |           |
| Received from him on deposit, ...      | 23 4 0    |            |           |
|                                        | <hr/>     | 23 4 0     |           |
| <b>R. T. H. GRIFFITH, Esq.</b>         |           |            |           |
| Received from him on deposit, ...      | 74 6 0    |            |           |
| Refund of Postage Stamps paid          |           |            |           |
| for sending Bibliotheca Indica, ...    | 3 0 0     |            |           |
|                                        | <hr/>     | 77 6 0     |           |
| <b>BABU KALLY COOMAR MITTER.</b>       |           |            |           |
| Received from him on deposit, ...      | 2 13 0    |            |           |
|                                        | <hr/>     | 2 13 0     |           |
| Carried over, Rs.                      |           | 9,395 15 0 |           |

No. 2.

*Oriental Fund for 1866.*

| DISBURSEMENTS.                                                                               |     |      | 1866.      | 1865.    |
|----------------------------------------------------------------------------------------------|-----|------|------------|----------|
| ORIENTAL PUBLICATIONS.                                                                       |     |      |            |          |
| Commission on the sale of Books,                                                             | 169 | 3 0  |            |          |
| Freight, ...                                                                                 | 189 | 2 0  |            |          |
| Packing Charges, ...                                                                         | 44  | 14 3 |            |          |
| Purchase of Postage Stamps,                                                                  | 48  | 14 6 |            |          |
| Petty Charges, ...                                                                           | 4   | 11 6 |            |          |
|                                                                                              |     |      | 456 13 3   | 456 7 3  |
| VESTED FUND.                                                                                 |     |      |            |          |
| Paid Commission to the Bank of Bengal for drawing Interest on the Government Securities, ... | 1   | 1 8  |            |          |
|                                                                                              |     |      | 1 1 8      | 1 1 8    |
| CUSTODY OF ORIENTAL WORKS.                                                                   |     |      |            |          |
| Salary of the Librarian, ...                                                                 | 360 | 0 0  |            |          |
| Establishment, ...                                                                           | 72  | 0 0  |            |          |
| Salary of Duffory, ...                                                                       | 96  | 0 0  |            |          |
| Book Binding, ...                                                                            | 31  | 2 0  |            |          |
| Books cleaning, ...                                                                          | 75  | 0 0  |            |          |
| Fee paid to the Bank of Bengal for Stamping Charges, ...                                     | 3   | 2 0  |            |          |
| Carpenter, Iron Nails and Screws for Suspending Shelves for the Bibliotheca Indica, ...      | 25  | 0 0  |            |          |
| Sundry charges for removing Bibliotheca Indica to St. Paul's School, ...                     | 124 | 2 0  |            |          |
| Extra Writer's Salary,                                                                       | 29  | 13 9 |            |          |
| Paid 25 per cent. increase of salaries for 6 months,                                         | 30  | 0 0  |            |          |
| Purchase of Stationery,                                                                      | 16  | 0 0  |            |          |
| Petty Charges, ...                                                                           | 7   | 12 0 |            |          |
|                                                                                              |     |      | 869 15 9   | 776 13 3 |
| LIBRARY.                                                                                     |     |      |            |          |
| Purchase of Books, ...                                                                       | 517 | 8 0  |            |          |
| Landing Charges, ...                                                                         | 8   | 4 9  |            |          |
| Binding 99 Sanskrit MSS. purchased from Benares, ...                                         | 39  | 6 0  |            |          |
|                                                                                              |     |      | 560 2 9    | 205 0 0  |
| PUNDIT CHHOTOO RAM TEWARI.                                                                   |     |      |            |          |
| Paid on his deposit, ...                                                                     | 3   | 8 6  |            |          |
|                                                                                              |     |      | 3 8 6      |          |
| DR. M. HAUG.                                                                                 |     |      |            |          |
| Paid on his deposit, ...                                                                     | 0   | 10 0 |            |          |
|                                                                                              |     |      | 0 10 0     |          |
| KUBI HERA CHUND KANJEE.                                                                      |     |      |            |          |
| Paid on his deposit, ...                                                                     | 41  | 0 0  |            |          |
|                                                                                              |     |      | 41 0 0     |          |
| Carried over, Rs.                                                                            |     |      | 1,933 3 11 |          |

## RECEIPTS.

Brought over, Rs. 9,395 15 0

Carried over, Rs. 9,395 15 0



## DISBURSEMENTS.

Brought over, Rs. 1,933 3 11

|                                   |           |           |           |
|-----------------------------------|-----------|-----------|-----------|
| <b>R. T. H. GRIFFITH, Esq.</b>    |           |           |           |
| Paid Postage Stamps for sending   |           |           |           |
| Bibliotheca Indica, ...           | 3 0 0     |           |           |
|                                   |           | 3 0 0     |           |
| <b>BARU KALLY COOMAR MITTER.</b>  |           |           |           |
| Paid on his deposit, ...          | 1 4 0     |           |           |
|                                   |           | 1 4 0     |           |
| <b>COLONEL E. T. DALTON.</b>      |           |           |           |
| Paid Registering fee and postage  |           |           |           |
| for sending MSS. to Chhota-       |           |           |           |
| Nagpore, ...                      | 0 11 0    |           |           |
|                                   |           | 0 11 0    |           |
| <b>AYIN I AKBARI.</b>             |           |           |           |
| Purchase of 5 copies of Ayin      |           |           |           |
| Akbari from Lt. Waterhouse, ...   | 226 4 0   |           |           |
| Printing with paper for circular  |           |           |           |
| for collecting MSS. of ditto, ... | 8 0 0     |           |           |
| Bearing on a parcel of ditto con- |           |           |           |
| taining MSS. from Dr. Leitner,    | 15 0 0    |           |           |
|                                   |           | 249 4 0   | 18 5 0    |
| <b>PALI GRAMMAR.</b>              |           |           |           |
| Purchase of Printing Demy Papers  |           |           |           |
| for, ...                          | 154 1 6   |           |           |
| Freight and Packing Charges for   |           |           |           |
| sending ditto, ...                | 13 5 9    |           |           |
|                                   |           | 167 7 3   |           |
| <b>BIOGRAPHICAL DICTIONARY.</b>   |           |           |           |
| Editing and Printing Charges, ... | 468 0 0   |           |           |
|                                   |           | 468 0 0   | 760 0 0   |
| <b>ALUMGIRI NAMAH.</b>            |           |           |           |
| Editing and Printing Charges, ... | 2,628 0 0 |           |           |
| Freight, ...                      | 6 4 6     |           |           |
|                                   |           | 2,634 4 6 |           |
| <b>MIMANSA DARSANA.</b>           |           |           |           |
| Editing and Printing Charges, ... | 762 0 0   |           |           |
|                                   |           | 762 0 0   | 237 0 0   |
| <b>NYAYA DARSANA.</b>             |           |           |           |
| Printing Charges, ...             | 292 6 0   |           |           |
|                                   |           | 292 6 0   | 756 0 0   |
| <b>TAITTIRIYA BRAHMANA.</b>       |           |           |           |
| Editing and Printing Charges, ... | 368 0 0   |           |           |
|                                   |           | 368 0 0   | 144 0 0   |
| <b>ASWALAYANA SRAUTA SUTRAS.</b>  |           |           |           |
| Editing and Printing Charges, ... | 416 0 0   |           |           |
|                                   |           | 416 0 0   | 1,376 0 0 |
| <b>KAMANDAKI.</b>                 |           |           |           |
| Editing Charges, ...              | 96 0 0    |           |           |
|                                   |           | 96 0 0    | 224 0 0   |
| <b>TAITTIRIYA ARANYAKA.</b>       |           |           |           |
| Editing and Printing Charges, ... | 365 0 0   |           |           |
|                                   |           | 365 0 0   | 512 0 0   |
| <b>BRIHAT SANHITA.</b>            |           |           |           |
| Printing Charges, ...             | 462 10 0  |           |           |
|                                   |           | 462 10 0  | 902 0 0   |

Carried over, Rs. 8,219 2 8

## RECEIPTS.

Brought over, Rs. 9,395 15 0

|                        |     |         |          |
|------------------------|-----|---------|----------|
| BALANCE OF 1865.       |     |         |          |
| In the Bank of Bengal, | ... | 519 8 6 |          |
| Cash in hand, ..       | ... | 5 8 5   |          |
|                        |     | <hr/>   | 525 0 11 |

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 Rs. 9,920 15 11
 

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Examined,  
 Sd. PROTAP CH. GHOSH, *Asst. Secy.*  
*Asiatic Society Bengal.*

Errors and Omissions Excepted.

Sd. BUDDINATH BYSACK,  
*Cash Keeper,*  
*Asiatic Society Bengal.*

Examined and found Correct.

Sd. DAVID WALDIE, }  
 Sd. S. H. ROBINSON, } *Auditors.*

## DISBURSEMENTS.

|                                   |     |    |                   |       |       |       |
|-----------------------------------|-----|----|-------------------|-------|-------|-------|
|                                   |     |    | Brought over, Rs. | 8,219 | 2     | 8     |
| BADSHAH NAMAH.                    |     |    |                   |       |       |       |
| Editing and Printing Charges, ... | 876 | 0  | 0                 |       |       |       |
|                                   |     |    |                   | 876   | 0     | 0     |
| • ASWALAYANA GRIHYA SUTRAS.       |     |    |                   |       |       |       |
| Editing Charges, ...              | 96  | 0  | 0                 |       |       |       |
|                                   |     |    |                   | 96    | 0     | 0     |
| TATTIRIYA SANHITA.                |     |    |                   |       |       |       |
| Editing Charges, ..               | 120 | 0  | 0                 | 120   | 0     | 0     |
| SANKHYA APHORISM OF KAPILA.       |     |    |                   |       |       |       |
| Printing Charges, ...             | 208 | 12 | 0                 |       |       |       |
|                                   |     |    |                   | 208   | 12    | 0     |
| DASA RUPA.                        |     |    |                   |       |       |       |
| Printing Charges, ...             | 227 | 8  | 0                 |       |       |       |
|                                   |     |    |                   | 227   | 8     | 0     |
|                                   |     |    |                   | 9,747 | 6     | 8     |
| BALANCE.                          |     |    |                   |       |       |       |
| In the Bank of Bengal, ...        | 171 | 4  | 10                |       |       |       |
| Cash in hand, ...                 | 2   | 4  | 5                 |       |       |       |
|                                   |     |    |                   | 173   | 9     | 3     |
|                                   |     |    |                   | Rs.   | 9,920 | 15 11 |

Examined,  
Sd. PROTAP Ch. GHOSHE,  
Asst. Secy.  
Asiatic Society Bengal.

Errors and Omissions Excepted,  
Sd. BUDDINATH BYSACK,  
Cash Keeper,

Asiatic Society Bengal.

Examined and found correct,

Sd. DAVID WALDIC, }  
Sd. S. H. ROBINSON, } Auditors.







PROCEEDINGS  
OF THE  
ASIATIC SOCIETY OF BENGAL,

FOR NOVEMBER, 1867.



A General Meeting of the Society was held on Wednesday, the 6th instant, at 9 p. m.:

Dr. S. B. Partridge, Vice-President, in the chair.

The minutes of the last meeting were read and confirmed.

Presentations were announced:—

1. From Colonel C. S. Guthrie; 79 Sheets of the Ordnance Survey maps of England.
2. From Captain R. A. Cole; a copy of his Elementary Grammar of the Coorg language.
3. From Colonel J. T. Walker; copies of the administration report of the Great Trigonometrical Survey of India, and of the Topographical Survey in the Bengal Presidency, for 1864-65 and 1865-66.
4. From Babu Kedárnáth Banerjee, the publisher; a copy of *Chanda-kaushika Nátaka*, with commentaries.
5. From Pundit Satyabrata Swámi; the first No. of *Pratna-kamra-namlini*.
6. From F. Cockburn, Esq.; a specimen of *Sciurus palmarum*.
7. From J. Avdall, Esq.; a fossil elephant tooth from Caunti.
8. From John S. Harris, Esq.; a copy of a Japanese and English Dictionary.
9. From Babu Jadunáth Datta, a young Crocodile.

At the invitation of Dr. Partridge, Captain Anderson introduced two Andamanese lads to the meeting. He also laid before the meeting the following correspondence detailing the objects for which the boys had been brought to Calcutta. He had found them apt at learning the names

of things, and acquiring a parrot-like imitation of sounds. They had no objection to wearing clothes, but on the contrary showed an especial desire to wear them.

*From Lieut.-Colonel B. FORD, Superintendent, Port Blair.*

*To Captain T. C. ANDERSON, Barrack Master, Fort William.*

*Dated Port Blair, 3rd August, 1867.*

SIR,—In accordance with your expressed desire and offer, on the occasion of your visiting this settlement some months ago, to undertake the education of any Andamanese lad, who could be induced to go to Calcutta for that purpose, I have the honor to acquaint you that I referred the matter to Mr. J. N. Homfray, in charge of the Andamanese house at Port Mouat, in terms of my letter No. 248 dated 31st of May last, copy attached.

2. From his reply No. 5 A, dated 19th June last, copy attached, there appears to be no objection or difficulty in carrying out your object, so far as the children and their friends are concerned, and as it is a scheme which, if successful, is likely to be fraught with many advantages and benefit to the Andamanese themselves, and to the Government, in effecting an amicable understanding with the aborigines, as well as regards other interests between them and future residents and settlers on those islands, I beg to recommend that you now apply to the Supreme Indian Government for permission to carry out your scheme, and if sanctioned, I shall be glad to afford you all the assistance at my command in carrying it out.

I have the honor &c.,

(Signed) B. FORD, *Lieut.-Colonel.*

*From J. N. HOMFRAY, Esq. Asstt. to the Superintendent, in charge of the Port Mouat, Andaman Ids.*

*To Lieut.-Colonel B. FORD, Superintendent Port Blair.*

*Dated Port Mouat, 19th June, 1867.*

SIR,—I have the honor to acknowledge the receipt of your letter No. 248 of the 31st May last on the subject of an offer of Captain T. C. Anderson to undertake the education of an Andamanese lad, who would afterwards prove of great use to the world, particularly to those dwelling in these Islands.

I acknowledge the offer to be a most liberal and charitable one, with great advantages to be gained by all who take an interest in the



welfare of mankind; especially of those unfortunates, who have not yet the light of civilization thrown open to them.

I have enquired of the Andamanese on the subject, to which they have no objection, and I would suggest that the best way to carry it out to satisfaction would be as follows :—

I believe about the end of this year there is to be an Ethnological congress in Calcutta, in which case, I dare say, I might be required to show the races of these Islands, and on which occasion I could take such lads as are desirable and willing to remain behind in Calcutta for education. I would return with their parents or guardians, who would then be sure of the youngsters being taken care of and treated kindly. I would advise two or three being educated, as jointly they are likely to do more good than a single boy, whom their friends would doubt, and not take notice of on his return. It is necessary for them to keep up their own language in Calcutta, and also, on their return here, to keep up the English they would learn in Calcutta. They would also recall to each other past occurrences, which they would relate as instances to their friends, and which no doubt would be very interesting and useful to them. Should one die, the others could explain the cause to the tribe, on their return, and I am sure their parting from their friends would not be felt severely. By the same opportunity I would pay for the expense of one lad in living and education, and would further suggest that their separation from the tribe should not be for more than two years, after which period, on visiting them, should they express a wish to return to their homes, they ought to be allowed it, and again, if found necessary, and they be willing to return to Calcutta for education, it may be continued. This would show them our good intentions, and would increase their confidence in us. The lads should be treated kindly and with mildness, and not frequently flogged for not knowing their lessons and other trifles; firmness is necessary, which can be effected by withholding any indulgences from them. The mere knowing of the English language, with our habits, customs and manners, is a great boon without being great scholars. This should be the first two years' tuition: food and clothing will be the heavy expense.

I have &c.,

(Signed) J. N. HOMFRAY.

*From Lieut.-Colonel B. FORD, Superintendent.*

To J. N. HOMFRAY, Esq.,

*Dated Port Blair, 31st May, 1867.*

SIR,—On the occasion of the visit to this settlement, some months ago, of Captain T. C. Anderson, Barrack Master, Fort William, Calcutta, that officer made, I believe, an offer to you of undertaking the education of any Andamanese lad, who could be induced to go to Calcutta for that purpose; the object in view being eventually to send amongst the aborigines of those islands, a man of their own tribe, who might not only be an interpreter between them and us, but with whose aid perhaps greater ends might be accomplished.

2. I have the honour now to inform you, that I have by the last mail received a renewal from Captain Anderson of his former offer. This offer is a most liberal one, and I am of opinion that no pains should be spared to take advantage of it; and I should be much obliged to you therefore, if you will endeavour to induce any of the elders of the tribe, with whom we are most friendly, to nominate a lad, say from 7 to 10 years of age, whose friends they might be able to persuade for a time to part with him, in order to go to Calcutta for the purpose of education. Our Andamanese friends must have such a pleasurable recollection of Calcutta hospitality and kindness, (in which respect they owe much to yourself), that I entertain a hope that there would not be much difficulty in inducing the Andamanese to send a lad away for a time for the above purpose.

3. I would suggest, should there be any reluctance to send a single individual, that I would undertake to induce Captain Anderson to receive two lads, who would thus not only be happy in their companionship, but who, from living together, would be less likely to forget their mother tongue.

4. I should feel obliged by your giving me an early reply in this matter, as I am desirous of replying to Captain Anderson's offer, as requested, by the next mail.

I have, &c.

(Signed) B. FORD, *Lieut.-Col.*

*From A. H. HARRINGTON, Esq., Offg. Under-Secy. to the Govt. of India.*

*To Captain T. C. ANDERSON, Barrack Master, Fort William.*

*Dated Simla, the 9th September, 1867.*

SIR,—I am directed to acknowledge the receipt of your letter of the 21st ultimo, and to state in reply that the Governor-General in Council has much pleasure in acceding to your wish to undertake the charge of not more than two Andamanese lads, for the philanthropic purposes indicated in your letter, provided they are not removed from India, and that they are produced whenever required, either for inspection, or if Government should think it fit, for restoration to their friends.

I have, &c.

(Signed) A. H. HARRINGTON,

*From Lieut.-Col. B. FORD, Superintendent, Port Blair.*

*To Captain T. C. ANDERSON, B. S. C.*

*Dated Port Blair, 21st October, 1867.*

SIR,—I have the honor to inform you that, agreeably to your request, and by the permission of the Government of India, two Andamanese lads are forwarded by this opportunity, to be made over to you, in accordance with your philanthropic intentions as regards the undertaking of their education and improvement, with the view to their ultimately being a benefit to their fellow islanders on the Andamans.

Dr. J. B. Gaffney, in medical charge of the troops on Board the "Arracan," has been so good as to take charge of the lads, to make them over to you. As the steamer "Arracan" returns immediately to Calcutta, and as Mr. Homfray has had, consequently, but 24 hours' notice of her departure, he has not been able by this opportunity to send you the vocabulary you wish for, but trusts to do so at an early date.

The two lads have been selected by Mr. Homfray and myself; the objects we had in the selection were, to send such as were willing to go, whose relations had no objection to their being sent, who had themselves evinced intelligence, and were not too old for placing under tuition. Their names are.

Andaman names, { 1 Katoo.  
                          { 2 Katoo Moogtie.

"Scedi Boy"—The former name given by Mr. Homfray.

For facility of recognition these lads have been given the simple names of

|       |            |
|-------|------------|
| 1 Joe | } Andaman. |
| 2 Tom |            |

Mr. Homfray has rationed and made every provision for the lads on board the 'Arracan.'

The original enclosure of your letter of 12th ultimo is herewith returned.

I have, &c.  
(Signed) B. FORD, *Lieut.-Col.*

At the request of the chairman the boys sang a native song and performed a native dance.

The special thanks of the meeting were voted to Captain Anderson for the introduction of his interesting charges.

M. E. Petit, duly proposed and seconded at the last meeting, was balloted for and elected an ordinary member of the Society.

The following gentlemen were nominated candidates for ballot as ordinary members at the next meeting.

W. H. Stevens, Esq. C. E., proposed by Mr. V. Ball, seconded by Mr. Ormsby (for re-election).

G. King, Esq. M. D. 1st Central India Horse, proposed by Dr. Ewart, seconded by Mr. Ormsby.

J. S. Harris, Esq. proposed by Dr. Colles, seconded by Mr. Scott.

F. J. Chambers, Esq., India Carrying Co., proposed by Mr. W. King, seconded by Mr. Ormsby.

Lieutenant J. Johnstone, Superintendent of Elephant Khuddas, Central Provinces, proposed by Mr. Medlicott, seconded by Mr. H. F. Blanford.

J. W. Chisholm, Esq. Commissioner of Belaspore, Central Provinces, proposed by Mr. Medlicott, seconded by Mr. H. F. Blanford.

E. Gay, Esq. Finance Department, proposed by Dr. J. Anderson, seconded by Mr. Locke.

Letters from the following gentlemen, intimating their desire to withdraw from the Society were recorded:—

The Hon'ble E. Drummond.

Babu Súrathnath Mullick.

E. S. Robertson, Esq.

Mr. H. B. Medlicott moved the following, notice of which was duly given at the last meeting.

“That the latter portion of Rule 62 be altered to read as follows;— ‘for the purpose of taking into consideration special matters relating to the business of the Society, but not extending to the alteration of a Bye Law.’ ”

Some discussion arose on this motion as to the course that should be adopted in accordance with the Rules of the Society; at the conclusion of which, the Chairman notified that in accordance with Rule 43, the motion must be referred to the Council for Report.

The Council reported that they have re-elected Mr. H. F. Blanford, a member of their body and as General Secretary to the Society, in place of Mr. M. H. Ormsby who has resigned, and they recommended that a vote of thanks be given to Mr. M. H. Ormsby for his valuable services as Secretary.

The vote of thanks was unanimously carried.

Read a letter from the Secretary to the Government of India, forwarding, for the information of the Society, copies of the following circular letter to the local Governments, on photographing architectural remains and other works of art in India.

*Simla, the 29th August, 1867.*

SIR,—The desirability of conserving ancient architectural structures or their remains, and other works of art in India, and of organizing a system for photographing them, has attracted the attention of the Governor-General in Council, and, as the first step towards attaining these objects, I am directed to request that a list may be submitted, for the information of the Government of India, of all such remains or works of art as may exist in each district, together with a report of the measures that have from time to time been adopted to preserve them.

2. As regards photographing them, the Governor-General in Council is of opinion that the employment of professional skill will be unnecessary, and that the services of amateurs may with advantage be enlisted.

3. In this view, I am directed to request that arrangements may be made for the photographing by competent amateurs of all such

objects of architectural and artistic interest in their neighbourhood, as may be included in the list called for in the opening paragraph of this letter, and for their submission to the Secretary of State.

4. I am to add that some assistance may be given, where desired, either in the shape of travelling expenses, or by the purchase of a certain number of copies of really good photographs.

I have the honor to be,

SIR,

Your most obedient Servant,

(Signed) E. C. BAYLEY,

*Secretary to the Govt. of India.*

No. 4040.

Copy forwarded to the Foreign Department for communication and issue of the necessary orders to the Political Officers under its control.

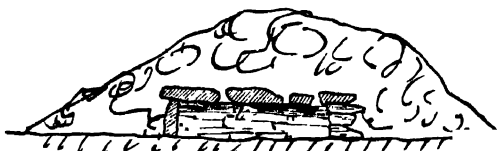
*Secretary to the Govt. of India.*

The following letter from H. P. Lemesurier, Esq., was read.

*Allahabad, Oct. 24th, 1867.*

MY DEAR GROTE,

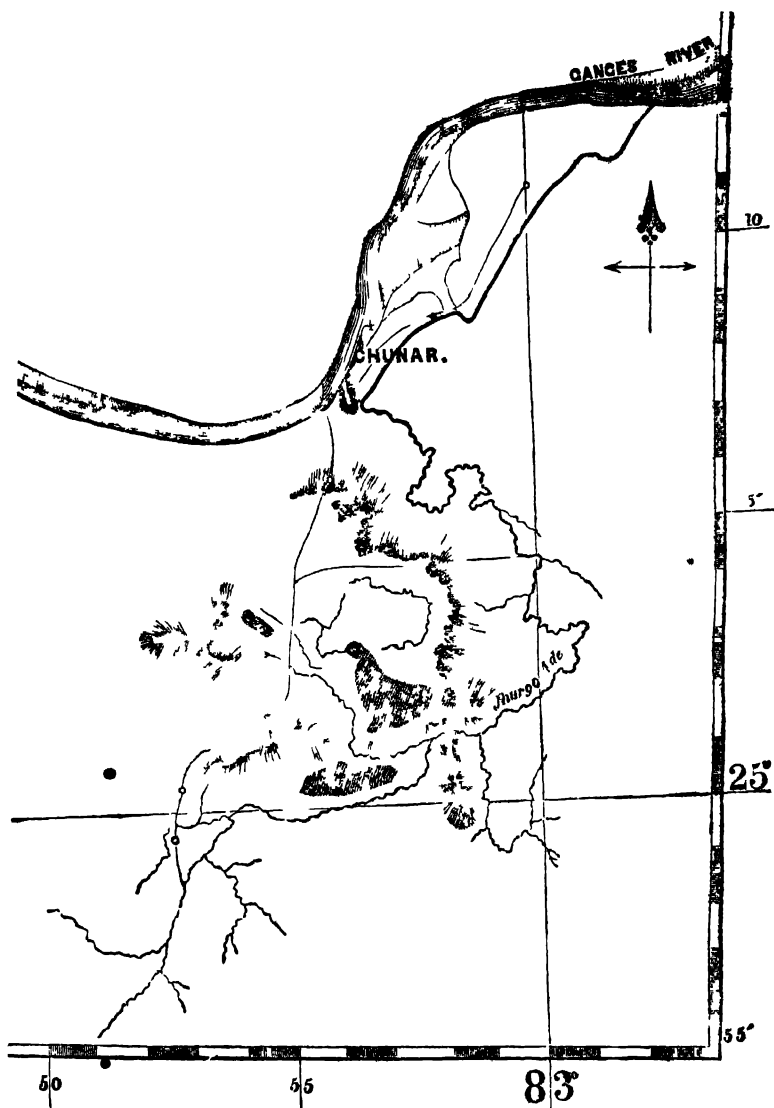
I have just hit upon a large area of ground covered with Cairns or stone barrows, each of which has contained a perfect kist: very many have been ransacked in times past by the natives. I opened one that seemed undisturbed. Its section was longitudinally thus:—



Three of the four walls were of dry rubble-stone; the fourth, the western one, was a stone on edge. Covering slabs about four feet, and from 18 inches to 27 inches wide. Length 6' 6" breadth 2' 0". Depth 18 inches or rather more; not any vestige even of a tooth or jaw bone, but mould of fine quality. Two chips of sandstone might have been in use. There must be a hundred tumuli in all. Have these been noticed before? I send sketch of the position.

(Signed)

H. P. LEMESURIER.



Area covered by tumuli shaded thus—



The Chairman drew attention to the discrepancy of the observations recorded at the Government Observatory during the late Cyclone, and those taken by Mr. Lafont and other observers : also to the destruction

of the Anemometer, so that the pressure of the wind was registered for a small part only of the storm. He moved that Government be solicited to make enquiry into the cause of these failures. The proposition was seconded by Mr. Medlicott and carried unanimously. The possibility of warning the town in cyclones was also a subject of discussion.

The receipt of the following communications was announced.

From Lieut.-Col. C. L. Showers. On the Meenas, a wild tribe of "Central India."

2. From W. Theobald, Esq. Jr. A descriptive Catalogue of the reptiles of British Burma.

3. From R. Michell, Esq., F. R. G. S. A Translation of "Survey of the western extremity of the Karakau Mountains by Captain Meyer," and of "A General Survey of the country lying to the westward of the Trans Ili Region between the rivers Chin and the Jaxartes or Syr Daria, by Col. Poltorotski."

Dr. Waldie made the following observations with reference to the communication he had made to the Society at the meeting of 3rd April last, on the subject of the Hooghly water:—

Observations had been continued during the succeeding hot and rainy seasons, in order to settle one or two points then left doubtful. As respects the river water of the hot season, the new observations had confirmed the former ones in regard to the amount of organic matter: much less common salt, however, had been found in the water than in the previous year. Possibly this might have arisen from the proper time of full tide not having been caught, although this seemed not a very probable explanation. With respect to the water of the rainy season, he had formerly brought particularly to notice its putridity: this year, however, it was not found to be so characterised or at least only to a very slight degree: had the odour been the only point of difference observed, it might have been supposed to be due to some mistake in observation, but several other points of difference were found to exist, and all of them corroborative of the indications of the first. Indeed, judging from the amount of vegetation formed in the water by long standing, the water of 1865 contained more organic matter than that of 1866, and this again than that of 1867. He was disposed to attribute these differences to some general cause, possibly connected with the amount of rainfall, but could form no decided opinion.



The particulars of these observations would be found in a post-script, dated 16th September, to the paper, Part III, just published in the Society's Journal.

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**LIBRARY.**

The following additions were made to the Library since the last meeting in September.

\*.\* The names of Donors in capitals.

*Presentations.*

The Journal of the Royal Geographical Society, Vol. 36.—**THE ROYAL GEOGRAPHICAL SOCIETY OF LONDON.**

Mélanges Asiatiques tirés du Bulletin de l'Académie Impériale des Sciences de St. Petersburg, Tome V. Chronologisches Verzeichniss der seit dem Jahre 1801 bis 1866 in Kasan gedruckten arabischen, türkischen, tartarischen und persischen Werke, als Katalog der in dem asiatischen Museum befindlichen Schriften der Art, von B. Dorn.—**THE AUTHOR.**

Selections from the Records of the Government of India, Foreign Department, No. LIII.—**THE GOVERNMENT OF INDIA, AND THE GOVT. OF BENGAL.**

Two copies of Professor Wilson's Glossary of Indian Terms.—**THE GOVERNMENT OF INDIA.**

Dattaka Çiromani.—**BABOO PROSONNOCOOMAR TAGORE.**

Chandakaushika nātaka.—**BABOO KEDARNATH BANERJEE.**

Annual Report and Transactions of the Adelaide Philosophical Society for 1865 and 1866 :—**THE SOCIETY.**

Annales Musei Botanici Lugduno-Batavi, edidit F. A. G. Miquel. Tome III. Fasc I—V.—**THE LEYDEN UNIVERSITY.**

Rahasyasandarbha, No. 42.—**BABU RAJENDRALALA MITRA.**

Bulletin de la Société de Géographie, for July and August, 1867.—**THE GEOGRAPHICAL SOCIETY OF PARIS.**

Mémoires de l'Académie Impériale des Sciences, Belles-Lettres et Arts de Lyon : new series ; Vols. XII, XIV and XV.—**THE IMPERIAL ACADEMY OF SCIENCES, BELLES-LETTRES AND ARTS OF LYONS.**

Annales des Sciences Physiques et Naturelles, d'Agriculture et d'Industrie : 2d series, Vols. IX and X.—**THE IMPERIAL SOCIETY OF AGRICULTURE & CO. OF LYONS.**

Indische Studien, Vol. X. No. 2.—**THE AUTHOR.**

Proceedings of the Natural History Society of Dublin. Vol. IV. pt. III.—THE NATURAL HISTORY SOCIETY OF DUBLIN.

Memoirs of the Geological Survey of India, Vol. VI, pt. 2.—THE GOVERNMENT OF BENGAL.

Selections from the Records of Government, North-Western Provinces, Part XLV.—THE GOVERNMENT OF THE NORTH-WESTERN PROVINCES.

Notes on the Propagation and Cultivation of the Medicinal Cinchonas or Peruvian Bark trees, by W. G. McIvor.—THE GOVERNMENT OF BENGAL.

An Elementary Grammar of the Coorg Language, by Captain R. A. Cole, Superintendent of Coorg.—THE AUTHOR.

The Anthropological Review, Nos. 18 and 19.—THE ANTHROPOLOGICAL SOCIETY OF LONDON.

The Journal of the Chemical Society, for July, August and September, 1867.—THE CHEMICAL SOCIETY OF LONDON.

Proceedings of the American Philosophical Society, Vol. X. No. 76.—THE AMERICAN PHILOSOPHICAL SOCIETY.

Memorie della Reale Accademia della Scienze di Torino, Vol. XXII.—THE R. ACADEMY OF SCIENCES OF TURIN.

Atti della R. Accademia Della Scienze di Torino, Vols. 1 and 2.—THE R. ACADEMY OF SCIENCES OF TURIN.

*Purchased.*

The Song of Songs, a pastoral drama, not by King Solomon, with notes by Satyam Jayate.

Adam's Wanderings of a Naturalist in India.

Forbes's Hindustani and English Dictionary, Part I.

Revue Archéologique : new series Vols. XIII and XIV, and Nos. 1, 2, 3, 4, 6, 7 and 8, 1867.

Encyclopédie Méthodique ; Histoire Naturelle des Vers. Vols. 1, 2, 3 and 4.

Tableau Encyclopédique et Méthodique des Trois Règnes de la Nature. Vers, Coquilles, Mollusques et Polypiers, Vols. 1, 2 and 3.

The Ibis, July 1867.

The Annals and Magazine of Natural History, Vol. 26, No. 116.

The Edinburgh Review, July, 1867.

Revue de Deux Mondes, 15th July, 15 August, and 1 September, 1867.

Revue de Zoologie, No. VIII. 1867.

Comptes Rendus, Nos. 1, and 3, 5, 6, 7, 8 and 9, Vol. LXV.

Bopp's Glossarium Comparativum Linguae Sanscritae, last part.

The Calcutta Review, August 1867.

The Indian Medical Gazette, October and November 1867.

Journal des Savants, Aout 1867.

Indische Studien, Vol. X. No. 2.

A Catalogue of Shells, British and Foreign, with a supplement by W. Wood.

Bentham and Hooker's Genera plantarum, Vol. I. Part III.

Tomlin's Comparative vocabulary of forty-eight languages.

The Annals and Magazine of Natural History, September, 1867.

Reeve's Conchologia Iconica, Parts 264 and 265.

*Exchange.*

The Athenæum for August, 1867.



PROCEEDINGS  
OF THE  
ASIATIC SOCIETY OF BENGAL,  
FOR DECEMBER, 1867.



A monthly general meeting of the Society was held on Wednesday the 4th December, 1867 at 9 p. m.

Dr. J. Fayer, President in the chair.

The minutes of the last meeting were read and confirmed.

A photograph by Messrs. Thepland and Bourne, of the two Andaman lads introduced at the last meeting was exhibited by Captain Anderson; and it was announced that members desiring to obtain copies might procure them at the photographers'.

The following gentlemen duly proposed and seconded at the last meeting were balloted for and elected as ordinary members.

W. H. Stevens, Esq. C. E.

G. King, Esq. M. D.

J. S. Harris, Esq.

F. J. Chambers, Esq.

Lieut. J. Johnstone,

J. W. Chisholm, Esq.

E. Gay, Esq.

The following were nominated as candidates for ballot at the January meeting.

Baboo Rakal Doss Haldar, Deputy Collector, Maunbhoom, proposed by Col. E. T. Dalton seconded by Dr. J. Anderson.

J. Boxwell, Esq. C. S. Officiating Deputy Commissioner, Western Doars, proposed by Lieut. J. Williamson seconded by Dr. J. Anderson,

The Rev. J. C. Browne, has intimated his desire to withdraw from the Society.

The Council reported that they have elected Coll. J. E. Gastrell and Dr. J. P. Colles, members of their body, in places of H. B. Medlicott, Esq. and Dr. J. Anderson who have resigned.

They announced also that they had nominated Col. J. E. Gastrell as Hon. Treasurer, and Dr. J. P. Colles as Natural History Secretary of the Society.

The council recommended that a special vote of thanks to be given to Dr. J. Anderson and H. B. Medlicott, Esq. for their valuable services as officers of the Society.

The proposition was agreed to unanimously.

A letter from Professor Bapu Deva Sastri with reference to a letter received some months since from Major Ellis was read. The following are the original letter and the reply.

*Southbrook Cottage ; Starcross ; near Exeter.*

*20th November, 1866.*

DEER SIR,—I beg to enclose a copy of an astronomical calculation, identifying a partial eclipse of the sun, recorded on a grant of land by Janamajaya, published p. 447, Vol. 6, Bengal Asiatic Researches, with one, given by Fergusson, which occurred on 3rd April, A. D. 889, for which I am indebted to the kindness and scientific knowledge of Captain Peacock, formerly of the Royal Navy ; and shall esteem it a particular favour, if you will, in the first instance, kindly be at the trouble of ascertaining, whether the pandits of India have any knowledge of the eclipse, which happened on the 3rd April, A. D. 889, about Sambat 946 Vikramaditya ; and afterwards proceed with the enquiry of testing by their knowledge the validity or otherwise of the identity of the two Eclipses, supposed to be established by Captain Peacock's postulate.

\* \* \* \* \*

R. R. M. ELLIS.

In explanation of the very great interest which I take in these enquiries, I should mention, that when I was agent in Bundelkhund, I held the office of Vice-President Delhi Archæological Society, and for several years when in constant communication with Sir Henry Elliot and Mr. Thomason about them.

Postulate regarding a partial eclipse of the sun on Sunday in the Krishna Paksha, or dark half of the moon in the month of Chaitra, when the sun was entering the northern hemisphere, the moon being in the Nakshatra Aswini; recorded on a grant of land on copper by Janamajaya, the son of Parikshita: published p. 44, Vol. 6, Bengal Asiatic Researches, 1809.

The words of the text are "Chaitramasa Krishna" or the dark half of the month, and as Chaitra answers to the month between 15th March and 15th April, the dark half would seem to imply the time of new moon for that month, at which time *only* could an eclipse of the sun happen; and this would be in March or early in April the dark half of the moon being then turned towards the earth, and within the limits of the 17th in the Lunar Nodes: as a solar eclipse only can happen when the moon's latitude, as observed geometrically, is less than the sum of the hemidiameters of the sun and moon combined; because the course of the moon in its path being oblique to that of the sun, makes an angle of  $5^{\circ} 35'$ .

Now in examining into the date of the eclipse named in the text, and working out the dominical letter and Epact according to the tables in the prayer-book as well as those given by Fergusson, it would seem to have been that named in Fergusson's astronomy at page 217, in Strack's Catalogue of Eclipses as having been observed at Constantinople on the 3rd April, A. D. 889; the record of the *Hindu* plates states that the moon was in the Nakshatra Aswini, which answers to the zodiacal sign *Aries*, and which would also coincide with the month "Chaitra," or between the 15th March, and 15th April, as the sign Aswini or the horse's head comprised a portion or period of the Zodiac—a little over 13 days—the dark shadow of the moon, and ergo, the sun would therefore be in Aswini on the 3rd April, the sun having entered the Northern Hemisphere, or the first star of *Aswini* on the 22nd March, coincident or nearly so with the sign of *Aries*, and quitted Aswini on the 4th April, to enter Bhaiani.

I have calculated all the other eclipses of the sun, happening between the 22nd and 31st March from the year 1261 down to 1699, twelve in number, or during the period of Aswini path, but not one of these happened on a Sunday, and no solar eclipse

took place in *Asvini* at any period except the 3rd April answering to Sunday.

There was a solar eclipse observed at Rome on the 1st April, A. D. 288, and one on the second April, 1307, observed at Ferrara, but neither of these fell on a *Sunday*, therefore I am of opinion that the one named in the text must have occurred on the 3rd April, A. D. 889.

(Signed) GEORGE PEACOCK, F. R. G. S.

Formerly *Master, Royal Navy*, 1835.

To Babú RAJENDRALALA MITRA, Hon. M. R. A. S. Phil. Secretary,  
*Asiatic Society, Bengal.*

SIR,—I have the pleasure to acknowledge the receipt of your letter No. 765 dated the 28th ultimo, together with extracts from Major Ellis' letter. He states in it, that the Solar eclipse, observed at Constantinople in the month of April, 889 A. D., happened on a Sunday in the *Krishna Paksha*, the month *Chaitra*, when the moon was in *Asvini*. But I have carefully ascertained that this eclipse occurred on Friday and not on Sunday. I have determined this also, that the eclipse answers to the 3rd April according to the old style, but by the new style it fell on the 8th April. Major Ellis mentions also that no Solar eclipse took place in *Asvini* at any period except the 3rd April answering to Sunday. But this is not the case, as a great Hindu Astronomer named *Ganesa*, the author of *Grahālaghava* says :

शके ज्योतिषतुल्ये दृष्टमरदि मघौ मासि रामेन्दुनाडो-  
तुल्ये दर्शेऽभिषिष्ये दिवकरदिवसे भानुसर्वपक्षे भूत् ।  
तस्मिन् प्रलेऽस्मिन् चास्मिन्नितरेषु बुधः काबचप्रविमुखा-  
स्मारा दद्याद्दिवाभ्याकुलितमिह जगत् तत्र वा वा जकार ॥

"In the year 1443 of the *Salivahana* era the *Sanwatsara* called *Vorsha* and the month of *Chaitra*, a total eclipse of the sun took place on Sunday at the time of new moon, 13 *ghatis* (from sunrise) in the *ashadhatri asvini*. At the time of obscuration the star *asvini* (a *Arctis*) even though it was too near to the sun, the planets Mercury and Venus, and the seven stars of Ursa Major &c., were visible, the owls were flying all about and all people were confused."



I have also calculated this eclipse, and found that *Ganesh* is quite right.

The time of this eclipse answers to the 6th April (O. S.) or the 17th April (N. S.) 1521 A. D.

Therefore it cannot be supposed that the solar eclipse recorded on the grant of land occurred on the 3rd April, 889 A. D. because it fell on Friday and not on Sunday.

Yours faithfully,

BAPU DEVA SASTRI.

*Benares, 21st Oct. 1867.*

Read a letter from Dr. J. L. Stewart of Lahore on the carnivorous habits of the Himalayan bear.

*Lahore, Nov. 25th, 1867.*

MY DEAR SIR,—It would appear that the problem has not hitherto been definitely solved, as to whether the Himalayan bears are ever carnivorous, except under stress of want of vegetable food. The following may accordingly be interesting to some members of the Society.

On 7th ultimo, Lieut. Chalmers and Mr. Sparling of the Forest Dept. reached Portee in Punji on the upper Chenab, lying at about 7500 feet above the sea, in order to inspect and extend certain Deodar plantations.

It was reported to them that on that morning a large brown Bear had fought with and killed a smaller one and eaten part of the body, at a spring close to the plantation and in sight of some of the labourers. The body of the smaller bear was found concealed under leaves and grass, a part near the belly having evidently been gnawed and torn off by the jaws of some powerful animal.

On the 10th it was reported that at the same place and within sight of several labourers, the same larger bear had fought with and killed another. The body of the latter, a female, was found by the two officers concealed under leaves, a considerable portion of the back having been consumed.

It would perhaps have been more satisfactory if, in both cases, the bodies had been left for a time, to discover if the cannibal would come back to complete his meal.

Near the spot there is abundance of walnuts and wild fruits of

which the bear is fond, as well as of standing buck-wheat, which is perhaps preferred to other kinds of vegetable food.

Yours very truly,

L. L. STEWART.

With reference to the above, Dr. Buckle mentioned having once possessed a Cashmere bear which though tamed and well fed, killed and ate a goat. He shewed an especial taste for old bones : and at last his carnivorous propensities rendered it necessary to destroy him.

The receipt of the following communication was announced.

From Colonel A. Fytche "A Memorandum on the Panthays of Yunan."

At the request of the President, Colonel A. Fytche then read the Memorandum as follows :—

"Considerable difficulties exist in procuring correct intelligence of the Panthays, or Mahomedan population of Yunan. In the first place, they were not inclined themselves to be communicative ; but rather assume a studied ignorance of their own affairs :—Secondly, communication can only be ordinarily held with them, through Chinese merchants and brokers, residents of Burma Proper, who speak the Burmese language ; and who, in addition to their own private and self-interested motives for preventing free intercourse with traders from Yunan, are moreover in the pay, or subject to the influence of the King of Burma. They well understand the royal policy of exclusiveness, and have been made acquainted with the several indirect orders which from time to time, have been issued by the Government, in order to restrict as effectually as possible, every means of intercourse between Panthays and foreigners of all nations. The little information, therefore, which it has been possible to collect from the above sources furnished me by Captain Sladen, and also from a few Panthays who visited Moulmain with a Shan caravan, when I was Commissioner of the Tenasserim and Martaban Provinces in 1861, is vague and meagre ; but such as it is, I will now briefly record it.

"A paper has been published in the Russian Military Journal for August 1866, on the late rising of the Dungens, or Mussalman population in Western China. I am of opinion that there is no political affinity between the Dungens of the North Western, and the Panthays of the South Western Provinces of China ; or rather, that the present

rising of the Dungens on the North, bears no relation to the former rebellion of the Panthays on the south, or to any subsequent movement of the Southern Mussalman population of Yunan, to throw off the Chinese yoke ; such movement having commenced as early as the year 1855.

"This opinion must be understood, however, to have reference only to the present attitude and circumstances of the Panthays in Yunan ; without any speculative allusion to causes, or the possibility of future combination ; for the Panthays of Yunane and the Dungens, are, after all, of the same race and religion, and are merely divided from each other, by the Province of Sechuen ; and a general struggle for independence, if it really arises, and is able to make head against the Chinese Government, will certainly include at no great distance of time, the whole of the Mahomedan population in China wherever found. The first sign of a combination between Panthays and Dungen, will be manifested by the fall of Sechuen, and the news of such an event would soon reach this Province.

"The term Dungen or Turgen is not known or comprehended by either Panthays or Burmese. The Mahomedans of the North Western Provinces of China are known to the Panthays, by the same denomination as they call themselves, "Mooselin," and to the Burmese as "Tharet." The word Panthay, or as it is sometimes pronounced Panzee, is of Burmese origin, and is a mere corruption of the Burmese word "Puthee," which signifies, or distinguishes Mahomedans from persons of other religions in Burma. The Chinese call the Panthays "Quayz." What they term the Mahomedans of Kansoo, I am not aware—possibly it may be Dungen or Turgen. The Mahomedans of Kansoo are said to have lately achieved their independence, and occupy that province under a chief named Abdool Jaffir.

"The Mahomedans of Yunan are merely a remnant, I should imagine, of the great wave of Mahomedan aggression, which, under Mahomed of Guznee, Mahomed Ghorî, and Gengis Khan, overran Persia, India, and a portion of Northern China : their ingress and progress in China, are separately given or accounted for by Chinese and Panthays. The Panthay account is somewhat mythical, and assumes at once the superiority of their race. The Chinese version

deals less in mystery, and is more in bearing with supposed historical facts. They are as follows :—

*“Panthay Version.* Once upon a time, China was subjected to a plague of evil spirits, who desolated the whole country, and in fact put a stop to the regular course of nature. The sun ceased to shew itself, excepting now and then, in obscure and fitful gleams; and the land refused to produce, or yield fruit in due season. During this calamitous state of affairs, the Emperor ‘dreamed a dream,’ in which a form was prominently revealed to him, in the dress of an Arab; but indicating at the same time, every appearance of peace and friendly goodwill. Astrologers and experts in such matters, interpreted the Emperor’s dream to signify, that the plague of evil spirits would, cease on the appearance of a force of Mahomedan Arabs who were well known to be a source of terror to evil spirits and devils of every description. The Emperor was convinced, and sent a mission direct to the Prophet Mahomed, in which he begged the assistance of a few of the Prophet’s followers. Mahomed sent 360 men, who, in due time, reached China. By virtue of their presence, the evil spirits vanished, and the country was restored to its former prosperity. The Arabs were treated with becoming honour, and allowed to settle and establish themselves, in the vicinity of the Royal Capital. But in course of time their numbers increased to such an extent that the Chinese Government became anxious about its own safety; and an arrangement was effected, by which the Arab population near Pekin was broken up, and sent in small parties to the confines of the Empire; where they have since established themselves, more or less firmly, and in some instances proclaimed their independence.

*“Chinese Version.*—About a thousand years ago, there was a great rebellion in China, and the Government was in danger. The reigning Sovereign at the time was Oung-lo-show; and being in tribulation, he sent for assistance to a certain King, named Razzee or ‘Khazee, who ruled over the countries to the West of China. A Mahomedan contingent of 10,000 men was sent, and with their assistance, the rebellion was suppressed, and the services of the contingent dispensed with. But a difficulty now arose, as to the return of the Mahomedans to their own country. They had been greatly reduced in numbers, and their inclination to stay where they were and settle

down in China, was encouraged by reports, which reached them, to the effect that a return to their own country was forbidden, owing to long residence abroad, and their pollution as Mahomedans by contact with swine and other abominations, which were known to abound in China. The remnant of the contingent was finally located in Yunan, and settling down there, became peaceful subjects of the Emperor of China.

"It is to be inferred that the Mahomedan population in Yunan was, for some centuries, at least, loyally disposed towards the Chinese Government; for no particular mention is made of them in Chinese History, as far as is known, after their domestication in Yunan, until the year 1855, when they rebelled and successfully threw off the Chinese yoke.

"The rebellion is stated to have originated and been carried out in this wise. The Panthays in Yunan had multiplied and become a flourishing and distinct community. They preserved their separate nationality and customs, but were nevertheless obedient to the Chinese laws. The Chinese and Tartar officials are said to have been oppressive, and the foreign population was specially marked out for the exercise of more than ordinary severity. Their industrious habits and general aptitude made the Mahomedans profitable subjects; whilst it rendered them, at the same time, victims to unjust and extortionate masters. Then a feeling of enmity and hate was engendered, with the usual results. The Loosonphoo Silver Mines of Yunan were worked by Panthays, under the superintendence of Chinese officers. On a certain day a dispute arose at the mines, and the miners, exasperated by unjust treatment, had recourse to force and murdered every Chinese officer they could find. The revolt of the miners, was at once followed by a general armed rising of the Panthays throughout Yunan. Being far inferior in number to the Chinese, they at first took to the woods and mountain fastnesses, whence they carried on a fierce guerilla warfare. Meeting every where with success, they were soon joined by large numbers of the neighbouring semi-independent hill tribes of Shans, Kakhyens,\*

\* The Kakhyens above alluded to are a portion of the vast horde of Singphos, that inhabit the mountainous districts of Northern Assam, and stretch round the north of Burma into Western China. They extend not only all along the Northern Frontier, but dip down Southward wherever the mountain ranges lead them, and nearly as far south as the latitude of Mandalay.

and others, when they soon extended their operations to the plains, and to the siege of large towns ; and the local Government, receiving no assistance from Peking, finally succumbed, the insurgents became supreme, and a separate Panthay Government was established with its Head Quarters at Tali or Talifoo, then only a city of secondary importance, but where the Mahomedan element had always been very strong. Feeble attempts have since been made, from time to time, to recover the lost Province, by the despatch of Imperial Troops from the Capital ; but the Chinese Government has never been able to make head against the Panthays ; and the troops sent have generally been repulsed, before they could even penetrate within the Yunan frontier.

“ The present Mahomedan Government of Yunan is presided over by a military chief styled Sooleman by the Panthays, and Tuwintsen by the Chinese. He has assumed the insignia of Royalty, by formal instalation on the guddee, and by the exclusive, and prerogative use of yellow clothing and appurtenances. This chief or king is assisted by four military and four civil ministers, the principal one of whom is established at Momein, a large town close to the Shan frontier, west of Yunan. There appears to be little departure, in the matter of administration, from the old form of Chinese Government, except being more military in its character. Taxation is extremely light, being restricted, as far as can be understood, to a moderate assessment on land.

“ The Panthays are Mahomedans of the Soonee sect, and pride themselves on their Arab descent : many of them are able to converse in Arabic, and their prayers are all in this language. They have mosques or musjids of the true Moslem type, and are fanatical and strict in their religious performances ; as far as I have been able to ascertain, however, there is no trace of any religious zeal, or motive, as the origin or pretext for the present rising of the Panthays against Chinese rule. The Chinese are generally tolerant of all religious persuasions, and unlikely to cause irritation to the Mahomedans by any interference with their religion. The Buddhist, wherever found, is untrammelled by conventional dogma, and far less imbued with the *odium theologicum*, or that contemptuous abhorrence of all creeds and customs other than his own, than is the case with other natives of the east, of

whatever creed or denomination. The dress of the Panthays is in accordance, for the most part, with Chinese habit ; though many of them cut their hair to a certain length, and allow it to fall back on the nape of the neck. They also wear, in many instances, a distinctive turban of more ample form than in use amongst Chinese. They are fair, tall, and strongly built men : are an interesting race or community of people : and after twelve years of absolute government in Yunan, it is not improbable that their future independence is secure.

“Panthay traders state that, during the past year, an embassy was received from the Emperor of China, in which the Imperial Government sued for a cessation of hostilities, and volunteered to cede Yunan to the Panthays, provided they would come to terms, and commit no further acts of aggression on neighbouring Provinces. The offer it is said was indignantly refused, and the Embassy was obliged to return to Peking, without accomplishing its object.

This, if true, bodes evil to our future intercourse with China through Yunan by Railway or otherwise. The trade viâ Bamo between China and upper Burma, amounted in 1854 (the year before the Mahomedan insurrection) to half a million of pounds sterling. No caravans from Sechuen or other Provinces of China, since the establishment of Mahomedan rule, have passed through Yunan ; and trade by this route has almost altogether ceased. But with Yunan alone, a large trade was formerly carried on, and it is hoped that the caravan route, at any rate, may be shortly re-opened. It possesses the unusual advantage of having been used for centuries as a line of traffic, and has maintained its vitality hitherto among all the disturbing influences of the flow and ebb of the Chinese and Burmese power, and is a cogent proof of the necessity for interchange of commodities between the respective countries.

“An apparent interminable feud has doubtless arisen between the Manchur dynasty, and the Mahomedan population of China which may, probably combined with other numerous causes, ultimately end disastrously to that dynasty. How long it will take for the Chinese Government to disintegrate and reappear under a new form ; what effect such a change would have on the independent Mahomedan population of the Western Provinces ; and whether the change will be brought about by them, are questions which may probably affect a future generation,

but are nevertheless full of interest to neighbouring Governments, and political speculators of the present day."

On the proposition of the President, the special thanks of the meeting were voted to Col. Fytche.

Major Lees exhibited a bronze hookah which had been dug up on his plantation in Cachar, and was very different from anything now used in the province, while in point of manufacture it is far superior to any now manufactured there.

He also read a letter from Messrs. Johnson and Drew of Cashmere, in which the writers announce the proposed establishment of an Himalayan Club for collecting, interchanging and publishing scientific and general information concerning the Himalayan range.

The President undertook to refer the letter to council.

#### LIBRARY.

The following additions were made to the Library since the last meeting in November.

\* \* \* The names of Donors in capitals.

#### *Presentations.*

Progress Report of Forest Administration in the Central Provinces, 1866-67.—THE GOVERNMENT OF INDIA.

La Gurlande Précieuse des demandes et des Réponses Publiée en Sanskrit et en Tileekan et Traduite Pour La Première Fois en Français by Ph. Ed. Foucaux.—THE TRANSLATOR.

Journal Asiatique, Tome IX.—THE ASIATIC SOCIETY OF PARIS.

Professional Papers on Indian Engineering, No. 17.—THE EDITOR.

Sitzungsberichte der Königlich Bayerischen Akademie der Wissenschaften Zu München, 1866 II. Heft II. III. and 1867 I. Heft I—IV.—THE ROYAL ACADEMY OF SCIENCES OF MUNICH.

Abhandlungen der Math.—Physikn. classe der Königlich Bayerischen Akademie der Wissenschaften Band XXXVII. Abth. I.—THE ROYAL ACADEMY OF SCIENCES OF MUNICH.

Abhandlungen der Histor. classe der Königlich Bayerischen Akademie der Wissenschaften, Band XXXV. Abth. II.—THE ROYAL ACADEMY OF SCIENCES OF MUNICH.

On the relations of Tanalia Philopotanus and Paludomus with a



review of the Cingalese species of the latter genera by H. F. Blanford, Esq. F. G. S.—THE AUTHOR.

Ueber die Branchbarkeit der in verschiedenen europäischen Staaten veröffentlichten Resultate des Recrutirungs-Geschäftes zur Beurtheilung des Entwicklungs-und Gesundheits-Zustandes ihrer Bevölkerungen von Dr. Th. L. W. Bischoff.—THE AUTHOR.

Latáifo-'l-ma'arif auctore Abu Mançur Abdolmalik ibn Mahommed ibn Isma'il at Tha'alibi quem librum E Codd. Leyd. et Goth-Edidit P. De. Joug.—THE EDITOR.

Zeitschrift der Deutschen morgenländischen Gesellschaft: herausgegeben von den Geschäftsführern, Band XXI. Heft III.—PROFESSOR DR. L. KREHL.

Indische Studien X.—THE EDITOR.

Journal of the Royal Geological Society of Ireland, Vol. I. pt. 3.—THE SOCIETY.

Meteorological Report for the Panjaab, 1866.—THE GOVERNMENT OF THE PUNJAUB.

Annual Report on the Administration of the Bengal Presidency foot 1866-67.—THE GOVERNMENT OF BENGAL.

Report of Native Papers for the week ending the 9th November, 1867.—BABU RAJENDRALALA MITRA.

Rahasya Sandarbha, Vol. IV. pt. 43.—BABU RAJENDRALALA MITRA.  
*Purchased.*

A Treatise on Natural Philosophy by Thomson and Tait, Vol. I.

The Journal of Sacred Literature, October, 1867.

The Annals and Magazine of Natural History, October, 1867.

Revue des Deux Mondes 15th September, 1867.

Revue it Magasin de Zoologie, November, 1867.

Deutsches Wörterbuch V—7 Comptes Rendus, Nos. 10, 11, 12.





# JOURNAL OF THE ASIATIC SOCIETY.

PART I.—HISTORY, LITERATURE, &c.

No. I.—1867.

*The Initial Coinage of Bengal.*—By EDWARD THOMAS, Esq.

[Received December 5th, 1866. Reprinted from the Journal of the Royal Asiatic Society of Great Britain and Ireland, Vol. ii. p. I. N. S.]

Towards the end of August, 1863, an unusually large hoard of coins, numbering in all no less than 13,500 pieces of silver, was found in the Protected State of Kooch Behár, in Northern Bengal, the contents of which were consigned, in the ordinary payment of revenue, to the Imperial Treasury in Calcutta. Advantage was wisely sought to be taken of the possible archæological interest of such a discovery, in selections directed to be made from the general bulk to enrich the medal cabinets of the local Mint and the Museum of the Asiatic Society of Bengal. The task of selection, and with it of inevitably final rejection, was entrusted to Bábu Rajendra Lál Mitra—an experienced scholar in many branches of Sanskrit literature, and who, in the absence of more practised Numismatists, courageously encountered the novel study and impromptu exposition of Semitic Palæography as practically developed in his own native land six centuries ago. The Bábu, after having assiduously completed his selections for the Government,\* was considerate enough to devote himself to renewed and more critical examinations of this mass of coined metal, with a view to secure for Colonel C. S. Guthrie (late of the Bengal Engineers), any examples of importance that might have escaped his earlier investigations. The result has been that more than a thousand additional specimens have been rescued from the

\* J. A. S. Bengal, 1864, p. 480.

Presidency Mint crucibles, and now contribute the leading materials for the subjoined monograph.

An autumnal fall of a river bank, not far removed from the traditional capital of *Kuteswar Rāja*, a king of mark in provincial annals,\* disclosed to modern eyes the hidden treasure of some credulous mortal who, in olden time, entrusted his wealth to the keeping of an alluvial soil, carefully stored and secured in brass vessels specially constructed for the purpose, but destined to contribute undesignedly to an alien inheritance, and a disentanglement at a period much posterior to that contemplated by its depositor. This accumulation, so singular in its numerical amount, is not the less remarkable in the details of its component elements—whether as regards the, so to say, newness and sharpness of outline of the majority of the pieces themselves, the peculiarly local character of the whole collection, or its extremely limited range in point of time. It may be said to embrace compactly the records of ten kings, ten mint cities, and to represent 107 years of the annals of the country. The date of its inhumation may be fixed, almost with precision, towards the end of the eighth century A. H., or the fourteenth century A. D. A very limited proportion of the entire aggregation was contributed by external currencies, and the imperial metropolis of Dehli alone intervenes to disturb the purely indigenous issues, and that merely to the extent of less than 150 out of the 13,500 otherwise unmixed produce of Bengal Mints.†

The exclusively home characteristics of the great majority of the collection are enlivened by the occasional intrusion of mementoes of

\* Col. J. C. Haughton, to whom we are mainly indebted for the knowledge of this *trouvaille*, has been so obliging as to furnish me with some interesting details of the site of discovery and illustrations of the neighbouring localities. Col. Haughton writes:—"The place where the coin was found is about three miles S. W. of Deenhatta, not far from the Temple of Kuteswaree (or Komit-Bwaree) on the banks of the river Dhurla. Near to this temple is a place called Gosain Morae, a short distance from which are the ruins of Kutesur Rāja's capital, called Kuteswaree-Pat, consisting of a mound of considerable extent, which has been surrounded with several ditches and walls, which are again protected at the distance of a mile or two by enormous mounds of nearly 100 feet high. The brass vessels, in which the treasure was deposited, were ordinary brass *lotahs*, to which the top or lip had not been fixed, but in lieu thereof the vessels were covered by canister tops, secured by an iron *spike* passing from side to side."

† I wish to explain the reservations I make in thus stating this total below that given in Rajendra Lal's list of 150 coins of seven Dehli kings (J. A. S. B.,

imperial re-assertions, and numismatic contributions from other independent sources aid in the casual illustration of the varying political conditions of the province, and of the relations maintained from time to time between the too-independent governors of a distant principality and their liege suzerains at Dehli.

Muhammadan writers have incidentally preserved a record of the fact, that on the first entry of their armies into Bengal, they found an exclusive *cowrie* or shell currency, assisted possibly by bullion in the larger payments, but associated with no coined money of any description ;\* a heritage of primitive barter, indeed, which survived undis-

September, 1864, p. 481). In the first place, I greatly mistrust the reading of the sixth king's title. Muhammad bin Tughlak was called *Fakhr-ud-din Jūnah* in his youth only ; on his first mission to the Dakhin in 721 A. H., the higher title of *Uluġh Khwān* was conferred upon him by his father, but from the date of his accession to the throne of Hindustan, he contented himself with the use of his simple name and patronymic ; no longer the "glory of the faith," he was the far more humble *الوثنى بتايد الرحمن*, or the conventional *المجاهد في سبيل الله* (Zia-i-Barni, Calcutta edit., p. 196), both of which were so persistently copied by the independent Bengal Sultans. Certainly no such title as *فخر الدين* occurs on any of the specimens of the *Kooch Bahār* collection, that the Bábu has selected for Col. Guthrie, with the exception of those bearing the names of Fakr-ud-din *Mubārak Shāh*.

The second question of the altogether improbable intrusion of coins of Muhammad Adil Shāh ("new type") I must meet in a more direct way, by assigning the supposed examples of his money to the potentate from whose mints they really came, that is, *Ikhṭiār-ud-din Ghāzī Shāh* (No. 7, *infra*), giving a difference in the age of the two kings, as far as their epochs affect the probable date of the concealment of this trouvaille, of more than two centuries (753 A.H. against 960 A.H.).<sup>a</sup> The Bábu has himself discovered his early error of making Shams-ud-din Firúz, one of the *Dehli Pathāns* (as reported in the local newspapers), and transferred him, in the printed proceedings in the Asiatic Society of Bengal, to an anomalous position at the end of the Bengal Pathāns (p. 483), while omitting to deduct him from the total number of "eight Dehli Pathāns," which reckoning has been allowed to stand at p. 480. In the matter of date, we are not informed why this king should be assigned to A.D. 1491, instead of to the true 1320 A.D. which history claims for him.

\* Minhāj-ul-Serāj, who was resident in Lakhnauti in A.H. 641, writes چمنان تقریر کردند کہ دران بلاد عمودہ بعضی مچیل روان است Tabakāt-i-Nāsiri, p. 149, Calcutta printed edition (1864). Ibn Batutah gives an account of the collection of the cowrie shells in the Maldivo Islands, from whence they were exported to Bengal in exchange for rice ; the gradational quantities and values are detailed as follows : سیال = 100 cowries, فال = 700.

<sup>a</sup> The title of Mohammed bin Tughlak on the specimens in the Society's cabinet is *المجاهد في سبيل الله* and the coin which was first taken for that of Adil Shah has on it *Ikhṭiār uddin Ghāzī Shah*.—Ed.

turbed in many of the out-lying districts up to the early part of the present century. The consistent adherence of the people to this simple medium of exchange, goes far to explain an enigma recently adverted to\* in my paper on the identity of Kṛaṇanda as to the general absence of all specimens of money of high antiquity within certain limits northward of the seaboard, and may serve to reconcile the anomaly of conterminous nationalities appearing in such different degrees of advancement when tried by similar isolated tests of local habitudes. For the rest, the arms of Islām clearly brought with them into Bengal what modern civilization deems a fiscal necessity—a scheme of national coinage; and the present enquiry is concerned to determine when and in what form the conquerors applied the theory and practice they themselves as yet but imperfectly realized.

When Muhammad bin Sām had so far consolidated his early successes in India, into a design of permanent occupancy, leaving a viceroy and generalissimo in Dehli, in the person of Kutb-ud-dīn Aibek, while his own court was still held at Ghaznī, the scattered subordinate commanders each sought to extend the frontiers of the faith beyond the limits already acquired; in pursuance of this accepted mission, Muhammad Bakhtīār Khiljī, *Sipahsālār* in Oude, in A. H. 599, pushed his forces southward, and expelled, with but little effort, the ancient Hindu dynasty of Nuddeah, superseding that city as the capital, and transferring the future metropolis of Bengal to the proximate site of Lakhnautī, where he ruled undisturbed by higher authority, till his own career was prematurely cut short in A. H. 602.

كنى=12,000. بـستو=100,000, four *bustūs* were estimated as worth one gold *dīnār*; but the rate of exchange varied considerably, so that occasionally a *dīnār* would purchase as many as twelve *bustūs*, or twelve lakhs of cowries! (French edit, iv., p. 121. Lee's Translation, p. 178.) Sir Henry Elliot mentions that "in India, in 1740, a rupee exchanged for 2,400 cowries; in 1756, for 2,560 cowries; and (1845) as many as 6,500 could be obtained for a rupee."—Glossary of Indian Terms, p. 373. They were estimated in the currency scheme of 1833 at 6,400 per rupee.—Prinsep's U. T., p. 2. Major Rennell, who was in Silhet in 1767-8, speaking of the cowrie money, remarks: "I found no other currency of any kind in the country; and upon an occasion, when an increase in the revenue of the province was enforced, several boat loads (not less than 50 tons each) were collected and sent down the Burrampooter to Dacca." As late as 1801 the revenues of the British district of Silhet "were collected in cowries, which was also the general medium of all pecuniary transactions, and a considerable expense was then incurred by Government in effecting their conversion into bullion."—Hamilton's Hindostan, London, 1820, i. p. 195.

\* J. R. A. S., vol. i., N. S., p. 473-4.

Considering the then existing time-honoured system of valuations by shells,—which would certainly not invite a hasty issue of coin,—Muhammad Bakhtiar's acknowledged subordination to Kutb-ud-dīn, who, so far as can be seen, uttered no money in his own name, it may fairly be inferred that if a single piece was produced, it formed a part only of an occasional, or special, Medallie mintage constituting a sort of numismatic Fatah-nāmah, or assertion and declaration of conquest and supremacy alone, and designedly avoiding any needless interference with the fixed trade by adventitious monetary complications, which so unprogressive a race as the Hindus would naturally be slow to appreciate.

Similar motives may be taken to have prevailed in the north, where the least possible change was made in the established currency of the country, extending, indeed, to a mere substitution of names in the vernacular character on the coin, which was allowed to retain the typical "Bull and Horseman" device of Prithvi Rāja and his predecessors. The pieces themselves, designated from their place of mintage *Dehli-wals*,\* were composed of a mixture of silver and copper in intentionally graduated proportions, but of the one fixed weight of thirty-two ratis, or the measure of the old *Purāna* of silver of Manu's day. Progressive modifications were effected in the types and legends of these coins, but no systematic reconstruction of the circulating media took place until the reign of Altamsh; who, however, left the existing currencies undisturbed, as the basis for the introduction of the larger and more valuable and exclusively silver *فضة* popularly known in after times as the *Tankah*,† a standard which may also be supposed

\* The name is written *دلي* in Kutb-ud-din Aibek's inscription on the minaret at Delhi. (Prinsep's Essays, i. 327). The *Tāj-ul-Maāsir* and other native authorities give the word as *دهليول*. Hasan Nizami, the author of the former work, mentions that Kubāchah, ruler of Sind, sent his son with an offering of 100 lāks of Delhi-wals to Altamsh, and no less than 500 lāks of the same description of coin were eventually found in Kubāchah's treasury, many of which were probably struck in his own mints. (See *Ariana Antiqua*, pl. xx., fig. 19; *J. A. S. B.*, iv., pl. 37, figs. 28, 29, 47; and Prinsep's Essays, i., pl. xxvi., figs. 28, 29, 47.)

† Erskine derives this name from the Chagatai Tūrki word, *tang*, "white." (*History of India under Bāber*. London, 1854, vol. i. p. 546). Vullers gives a tenuis, suff. *g*). Ibn Batutah carefully preserves the orthography as *تنك*, different and clearly preferable derivation in *تنك* (fort. ex. *تنك* s. *تنك* and *تنك*).

to have followed traditional weights in the contents assigned to it, as the 96 rati-piece modern ideas would identify with the *Tolah*; or it may possibly have been originated as a new 100 rati coin, a decimal innovation on the primitive Hindu reckoning by fours, a point<sup>e</sup> which remains to be determined by the correct ascertainment of the normal weight of the rati, which is still a debated question. My own results, obtained from comparative Numismatic data of various ages, point to 1.75 grains,\* while General Cunningham adheres to the higher figures of 1.8229 grains.†

\* J. A. S. Bengal, 1865, p. 25, and Numismatic Chronicle. Vol iv., N. S. p. 131, March, 1864.

† General Cunningham's deductions are founded on the following estimates:—"I have been collecting materials for the same subject [Indian Weights] for nearly twenty years, and I have made many curious discoveries. I see that Mr. Thomas quotes Sir William Jones as fixing the weight of the *Krishnala*, or *Rati* seed, at  $1\frac{1}{8}$  grain; but I am satisfied that this is a simple misprint of Jones's manuscript for  $1\frac{1}{4}$  or 1.833 grain, which is as nearly as possible the average weight of thousands of seeds which I have tested. The great unit of mediæval and modern times is the *tāka* of not less than 145 grains, of which six make the *chha-tāka*, or *chhatak*, equal to 870 grains, or nearly two ounces; and 100 make the *sataka*, or *ser*, the derivation being *sat-tāka*, or 100 *tāka*. For convenience I have taken, in all my calculations, the *rati* seed at 1.8229 grain. Then 80 *ratis* or 145.832 was the weight of the *tangka* of copper, and also of the golden *suvarna*, which multiplied by six gives 874.99 grains, or exactly two ounces for the *chha-tāka* or *chhatak*."—J. A. S. Bengal, 1865, page 46.

Mr. N. S. Maskelyne, of the Mineral Department, British Museum, who, some time ago, entered into an elaborate series of comparisons of Oriental weights, with a view to determine the identity of one of our most celebrated Indian diamonds, has been so obliging as to draw up for me the following memorandum, exhibiting the bearing of an entirely independent set of data upon the question under review, the true weight of the Indian *Rati*. The value of this contribution in itself, and the difficulty of doing justice to it in an abstract, must plead my excuse for printing it in extenso in this place:—

I shall confine my answer to your question about the rati to the estimate of it, as derived from the *Mishkāl*. The other channel of enquiry, that namely of Hindoo metrology and numismatics, is too complicated, and so far as I have been able to follow it, too unsatisfactory in its results, to justify my urging any arguments derived from it. Indeed, the oscillations in the currencies, and our knowing so few very fine coins of reigns before Shir Shah, of critical value, make this branch of the subject almost unapproachable to one who is not an Oriental scholar. I would premise, however, that I do not believe very accurate results are to be obtained solely from the weights of coins, except in the few cases where, as in the coins of Akbar, or of Abd-el-Malek ben Merwān, we have some literary statements about them. Nor can you get any result from weighing carob beans to determine the carat, or abrus seeds to determine the *rati*. I weighed, long ago, hundreds of *ratis*, that Dr. Daubeny lent me, with an average of 1.694 troy grains. Sir William Jones found, I believe, one of 1.318, and Professor Wilson, I think, another value again. They vary according to the soil and climate they are grown in, and the time and atmosphere they have been kept in.

My investigation of the rati originated in a desire to determine whether the diamond, now the Queen's, was the same that Baber records as having been given to Humayūn at the taking of Agra, after the battle of Paniput, and which



However, these silver coins of Altamsh, let their primary static ideal have been based upon a duplication of the dirhams of Ghazni,

had once belonged to Alá-ed-dín (Khilji). I also was led to suppose that the diamond Tavernier saw at the Court of Aurungzebe was the same, and that he had confounded it with one that Meer Jumla gave to Sháh Jehán, and that had been recently found at Golconda. I would here observe that Tavernier's weights can be very little trusted; I can give you my reasons for this assertion, if you wish for them.

Báber, in his memoirs, says the weight of Humáyún's diamond was about 8 mishkál. In his description of India, he gives the following ratios of the weights in use there:—

|         |   |           |   |                |            |
|---------|---|-----------|---|----------------|------------|
| 8 ratis | = | 1 máshah. |   |                |            |
| 32 "    | = | 4 "       | = | 1 Tang (Tank). |            |
| 40 "    | = | 5 "       | = | =              | 1 mishkál. |
| 96 "    | = | 12 "      | = | =              | 1 Tola.    |

Jewels and precious stones being estimated by the tang. Furthermore he states 14 tolas = 1 sir, 40 sirs = 1 man etc. Thus, then, the 8 mishkál would be 320 ratis.

Tavernier says the diamond he saw weighed 319½ ratis. The Koh-i-Núr, in 1851 (and, I believe, in Báber's day also), weighed 589.5 grains troy. The theory that it was Alá-ed-dín's diamond, would demand—

|                                |           |        |         |
|--------------------------------|-----------|--------|---------|
| • a mishkál (8)                | weight of | 73.7   | grains. |
| a tola (3½)                    | "         | 176.85 | "       |
| a tank (10)                    | "         | 58.95  | "       |
| a másha (40)                   | "         | 14.745 | "       |
| a rati (320 of 8 to the masha) | "         | 1.8425 | "       |
| — (240 of 6 ;)                 | "         | 2.533  | "       |

. Now, as to the mishkál—the Mahommadan writers speak of it as not having altered from the days of the Prophet. Doubtless, it has been a pretty permanent weight, and very likely, in Makrizi's time, was but slightly various in different places. At present, the following table represents the different mishkál, so far as I have been able to ascertain them.

|                                                                                                     |         |         |
|-----------------------------------------------------------------------------------------------------|---------|---------|
| The gold and silver mishkál of <i>Bassorah</i> = 1½ dirham .. .. .                                  | = 72    | grains. |
| The " " mussal or mishkal of <i>Gamroon</i> (71.75 miscals = 100 mahmoudias = 5136 grains) .. .. .  | = 71.6  | "       |
| The gold and silver mishkal of <i>Mocha</i> = 24 carats = 24½ vakyá (of 480 grains, nearly) .. .. . | = 72    | "       |
| That of <i>Bushire</i> = ⅞ of a maund of 53784 grains .. .. .                                       | = 74.7  | "       |
| The metical of <i>Aleppo</i> and <i>Algiers</i> .. .. .                                             | = 73    | "       |
| The " of <i>Tripoli</i> .. .. .                                                                     | = 73.6  | "       |
| In <i>Persian</i> , the demi mishkál = ⅙ of the batman of <i>Chessay</i> (of 8871 grains) .. .. .   | = 73.96 | "       |
| The taurid batman and mishkál = half the above .. .. .                                              |         |         |
| The mishkál corresponding to the (¾) dirham used for gold and silver in <i>Persia</i> .. .. .       | = 74.5  | "       |
| The abbasi corresponding to 1 mishkál, <i>Marsden</i> says .. .. .                                  | = 72    | "       |
| The modern debased mishkál of <i>Bokhara</i> .. .. .                                                | = 71    | "       |

Báber, in speaking of the mishkál, may either mean his own Bokharan mishkál, or, as seems more probable, the current mishkál as existing at that time in India, in short, the "Indian or Syrian mishkál" of the Mahommadan writers—which was the Greek mishkál + 2 kirats. The modern debased mishkál of Bokhara we may leave out of our comparisons. It is surely a degraded weight in a country that has undergone an eclipse.

The old "Greek Dinar" is of course the Byzant, or solidus aureus—the denarius of Byzantium. It was nominally coined 72 to the Roman lb. The Byzantian Roman lb. in the British Museum weighs 4995 grains, so the solidus

or, as is more probable, elaborated out of the elements of ancient

was nominally coined at 69.4 grains. It really issued from the mint at a maximum weight of 68 (a very few of the most finely preserved coins reaching this amount). Now taking Makrizi's statement that the mishkál was 24 kirats, and that of the Ayin-i-Akbari that the Greek mishkál was 2 kirats less than this; we find the weight of the mishkál =  $68 + \frac{4}{3} = 74.18$  grains troy. Again, Makrizi mentions that Abdel-malek-ben-Merwah coined dinars and dirhams in the ratios of  $21\frac{1}{2}$  kirats : 15 kirats. Now this Caliph's gold coins in the British Museum (in a very fine state of preservation), weigh 66.5 grains, and his silver, also well preserved, 44.5. Taking the former as coined at 67, we have the ratio :

$$\text{Dinar} : \text{Dirham} = 21\frac{1}{2} : 15 = 67 : 46.2,$$

Which latter gives a probable weight for the dirham as originally coined. (In Makrizi's time the ratio was  $\text{dinar} : \text{dirham} = 10 : 7 = 21.75 : 15.22$ ; or supposing the gold coin unchanged at 67, the silver dirham would become 46.88). Then, as the ratio of the dinar (or gold mishkál) to the mishkál weight =  $21\frac{1}{2} : 24$ , we have for the mishkál weight a value of 73.93 grains.

These two values, thus severally adduced from different data—viz., 74.18 and 73.93—sufficiently nearly accord to justify, I think, our striking the balance between them, and declaring of the ancient mishkál—("the Syrian or Indian mishkál") to have been very nearly 74 grains. Hence the kirats would be 3.133 grains, troy. The modern carat varies from 3.15; the modern Indian carat to 3.28, the old French carat (made this probably to be an aliquot part of the old French ounce). The English carat = 3.168; the Hamburg = 3.176, and the Portuguese = 3.171.

The above value of the mishkál accords extremely well with my theory about the diamond.

That the "Greek Dinar" of Makrizi was the Sassanian gold is not at all likely, although the silver dirham was, no doubt, originally derived from the Sassanian drachma. Of the few gold pieces of Sassanian coinage, the one in the Museum, of Ardashir I., weighs now 65.5, and could not have been coined at less than 66.5 grains—which would give a mishkál of 72.04. But under the Sassanids, the gold coinage was quite exceptional, and was not large enough to have formed the basis of the monetary system of the Caliphs, which was professedly founded on Greek coins, *current*.

As to the Bokhárán mishkál of Báber's time, how are we to arrive at it? You—and if you can't, who can?—are able to make little firm ground out of the weights of Sassanian, or Ghasnavid coins—nor will the coins of the Ayubite, Mamluke and Mamluke Bahrite Caliphs (of which I have weighed scores), give any much more reliable units on which to base the history of the progress of change in the mishkál. The limits of its variation in modern times seem to have lain between 74.5 and 72 troy grains; I believe 74 as a near as possible its true original weight, the weight of the Syrian and of the Indian mishkál. This would give the ratio on the goldsmith's standard of 8 to the masha, and 48 to the mishkál, as 1.85 grains, and the limits of this ratio would be 1.862 and 1.80. The value of the jeweller's ratio (6 to the mashi) would be for the 74 grain mishkál 2.47 grains, and its limits would be 2.483 and 2.40.

That Báber's and Humayún's now worn and dilapidated coins of 71 and 71.5 grains were mishkáls, is not improbable; but they certainly were not coined at less than 74 grains.

Without entering into the Indian numismatical question, I may remind you of Tuglak's coin of 174 grains (one in the British Museum = 172.25), probably coined at 175 or 176; a fair weight of issue for a coin nominally of some 177 or 178 grains. These coins, I believe, you consider to represent the tola. A tola of 177.6 would accord on the ratios of Báber's table with a mishkál of 74 grains. I am strongly tempted to enter further into this question of the ponderary systems of India, but I am warned by your own able papers of the difficulties in the path of one who deals only in translations and in the weight of coins.

24th Nov., 1865.

Indian Metrology—may be quoted in their surviving integrity of weight and design, as having furnished the prototypes of a long line of sequent Dehli mintages, and thus contributing the manifest introductory model of all Bengal coinages.\*

The artistic merits of the produce of the southern mints, though superior in the early copies to the crude introductory issues of Altamsh, seldom compete with the contemporary design or execution of the Dehli die-cutters, and soon merge into their own provincialisms, which are progressively exaggerated in the repetition, until, at last, what with the imperfection of the model, the progressive conventiona-

\* There three are varieties of Altamsh's silver coinage, all showing more or less the imperfection of the training of the Indian artists in the reproduction of the official alphabet of their conquerors. The designs of these pieces were clearly taken from the old Ghazni model of Muhammad bin Sâm's Dirhams and Dînars, and the indeterminate form of the device itself would seem to indicate that they mark the initial effort of the new Muhammadan silver currency which so soon fixed itself into one unvarying type, and retained its crude and unimproved lettering for upwards of a century, till Muhammad bin Tughlak inaugurated his reign by the issue of those choice specimens of the Moneyer's art which stand without compeers in the Dehli series.

No. 1, Silver. Size, vii.; weight, 162.5. Supposed to have been struck on the receipt of the recognition of the Khalif of Baghdád in 626 A. H.

Obverse: square area, with double lines, within a circle.

Legend, لا اله الا الله محمد رسول الله

Reverse: Square area, with double lines, within a circle.

Legend, قى عهد الامام المستنصر امير المومنين

No. 2, Silver. Size, viii.; weight, 168.5. Date, 630 A. H.

Obverse: Square area, with double lines,

Legend, { السلطان الاعظم شمس الدنيا والدين }  
{ ابو المظفر اليتيمس السلطان ناصر امير المومنين }

Reverse: Circular area.

Legend, { لا اله الا الله محمد رسول الله المستنصر }  
{ امير المومنين }

Margin,

ضرب هذا اله

Mr. Bayley notices the occasional change of the name of the piece to the generic اسمك as well as the ignorant substitution of المستنصر بامر الله for the Khalif's true title. J. A. S. B., 1862, p. 207. Col. Guthrie's coin (Type No. 2) discloses a similar error.

Legend, قى عهد الامام المستنصر امير المومنين  
Margin, ضرب هذه الفضة

No. 3, Silver. Size, viii.; weight, 163.5 gr.

Obverse, as No. 2, but the square area is enclosed in a circle.

Reverse: Square area enclosed within a circle, identical with the obverse design.

lism of the designers, and the ignorance and crude mechanical imitation of the engravers, their legends become mere semblances of intelligible writing, and, as the plates will show, like Persian *shikastah*, easy to read when one can divine what is intended, but for anything like precision in obscure and nearly obliterated margins, a very untrustworthy basis for the search after exact results.

The different mints each followed its own traditions, and the school of art stood generally at a higher level in the eastern section of the kingdom, especially when Sonárgaon was held by its own independent rulers. The lowest scale of die execution, exemplified in the present series, was reserved for the capital of the united provinces under the kingship of Sikandar (No. 23 *infra*). The numismatic innovations of Muhammad bin Tughlak, were felt and copied in the south, especially in the reproduction of the titular legends, but his own coins struck at the "city"—he would not call it capital—of Lakhnaúti, evince the haste and carelessness of a temporary sojourn, and still worse, the hand of a local artist, all which short-comings may be forgiven to a monarch who in his own imperial metropolis had raised the standard of the beauties of Arabic writing, as applied to coin legends, to a position it had never before attained, and which later improved appliances have seldom succeeded in equalling.

The Bengal Sultáns, mere imitators at first, were original in their later developments of coin illumination, and the issues of the fully independent kings exhibit a commendable variety of patterns in the die devices, damaged and restricted, however, in the general effect by the pervading coarseness and imperfection of the forms of the letters. Then, again, the tenor of the inscriptions is usually of independent conception, especially in the refusal to adopt the ever recurring *kalimah*, and in the suggestive mutations of titles assigned to the lieutenants of the prophet on earth, whose names they did not care to learn. So also was their elaboration of the titular adjuncts of the four Imáms uninfluenced by northern formula; many of which conventionalisms survived for centuries, till Shír Sháh, in the chances of conquest, incorporated them into the coinage of Hindustán, during the éxile of the temporarily vanquished Humáyún.

The standard of the Bengal coinage was necessarily, like the pieces themselves, a mere imitation of imperial mint quantities, and the

early issues will be seen to follow closely upon the proper amount in weight contemplated in the Dehli prototypes; but one of the curious results the Kooch Behár collective find determines is, that though the first kings on the list clearly put forth money of full measure, their pieces were, in most cases, subjected to a well understood Indian process of boring-out, or reduction to the exact weight to which we must suppose subsequent kings lowered the legal standard of their money, so that, although some of the silver pieces of Kai Káús and Fírúz have escaped the debaser's eye, and preserve the completeness of their original issue denomination; the great majority of the older coins have been brought down to the subsequent local standard of 166 grains, at which figure, in troy grains, the bulk of the hoard ranges; or, in more marked terms, 166 grains is the precise weight of the majority of the very latest and best preserved specimens, which must have been consigned to their recent place of concealment when very fresh from mints but little removed from the residence of the accumulator of the treasure, and be held to represent coin which could scarcely have changed hands.

The intrinsic value of the money of these sovereigns follows next in the order of the enquiry. This department of fiscal administration might naturally have been expected to have been subject to but limited check or control, when regulated by the uncertain processes of Oriental metallurgy; but, in practice, it will be seen that some of the native Mint-masters were able to secure a very high standard of purity, and, what is more remarkable, to maintain a singularly uniform scale in the rate of alloy. In the case of the imperial coins subjected to assay in Calcutta, specimens spreading over, and in so far, representing a sequent eighty years of the issues of the northern metropolis, vary only to the extent of six grains in the thousand, or 0.6 per cent. As the Dehli coinage proves superior, in point of weight, to the southern standard, so also does it retain a higher degree of purity; the 990 and 996 of silver to the test total of 1,000 grains, sinks, in the earliest examples of the Bengal mintages, to 989, from which figures it experiences a temporary rise, in possibly exceptional cases, under Bahádúr Sháh, who may be supposed to have brought down, with his reinstated honours and the coined treasure so lavishly bestowed upon him by Muhammad bin Tughlak, on his restoration to the government of

Sonargaon, certain implied responsibilities for the equity and fulness of his currencies ; while in the subsequent irregularly descending scale, Azam Sháh's officials arrived at the most unblushing effort of debasement, in the reduction of silver to 962 grains. Among other unexpected items for which the aid of modern science may be credited, is the support which the intrinsic contents of the erroneously-classed coins of Adil Sháh under native interpretation, lend to the correctness of the revised attribution of the pieces themselves suggested by the critical terms of their own legends, in the manifest identity of their assay touch with the associate coins of the lower empire of India.

Colonel Guthrie has furnished me with the following data, concerning the assay of the various coins composing the Kooch Bahár hoard :—" When the Bengal Asiatic Society made their selection of coins from the trove, they set apart four of each description for the Mint, two being for special assay, two for the Mint collection. The result of the assay was as follows (1,000 represents absolute purity) :"

## DEHLI COINS.

1. Balban (A. H. 664) ... 990 and 996
2. Kai Kobád (A. H. 685) 990 and 996
3. Ghás-ud-din Tughlak (A. H. 720) 990.
4. Adil Sháh [*i. e.* Ghází Sháh of Bengal, A. H. 751] 989.

## BENGAL COINS.

1. Shams-ud-din Firuz..... 989
2. Bahádur Sháh ..... 988 and 993
3. Mubárák Sháh ..... 987
4. Iliás Sháh (1st type) 989; (2nd) 982; (3rd) 988.
5. Sikandar Sháh (return lost).
6. Azam Sháh (1st type) 981; (2nd) 989; (3rd) 962; (4th) 977; (5th) 985.

A question that has frequently puzzled both Oriental and European commentators on the history of India, has been the intrinsic value of the current coin at the various epochs referred to, so that the most exact numerical specifications conveyed but a vague notion of the sterling sum contemplated in the recital by any given author. Numismatists have been for long past in a position to assert that the Dehli Tankah contained absolutely 173 grains, which would presuppose a theoretical issue weight of 174 or 175 grains, and a touch of nearly pure silver; but assuming this specific coin to have been a *white* or *real* "Tankah of Silver" (تَنكِه نقره) a doubt necessarily remained as to what was to be understood by the alternative black Tankah (تَنكِه سیاه). Nizám-ud-din Ahmad, in his *Tabakát-i-Akbari*, seems to assign the introduction of these black Tankahs to Muhammad bin Tughlak, who notoriously depreciated the currency to a large extent, before he re-

sorted to the extreme measure of a forced currency, though it may be doubted whether any such depreciation would have been thought of, even if there had been time to effect the conversion, at the very commencement of his reign, to which period Nizám-ud-din attributes the issue of these pieces, in the apparent desire of explaining the bare possibility of the possession of such numerical amounts as are stated to have been squandered in largesses by the newly-enthroned monarch. However, the real debasement of the coin need not have extended much beyond the point indicated by the superficial aspect of his own Bengal mintages, and Azam Sháh's coins of the same locality probably exceed that accusatory measure of debasement; while, on the other hand, Muhammad bin Tughlak, on reverting to specie currencies, after his futile trial of copper tokens, seems to have aimed at a restoration of the ancient purity of metal in his metropolitan issues, as I can quote a coin of his produced by the Dehli Mint in A. H. 734, which has every outward appearance of the component elements of unalloyed silver, and equally retains the fair average weight of 168 grains.\* All these evidences would seem to imply that the Bengal ratio of purity was intentionally lower, and that a very slight addition to the recognised alloy would bring the local issues fairly within the category of black Tankahs. Such a supposition of the inferiority of the coinages of the southern kingdom appears to be curiously illustrated by Báber's mentioning that, in A. H. 932, a portion of the revenues of the district of Tírhút, a sort of border-land of his kingdom, which did not extend over Bengal, was payable in *Tankah Nukrah*, and the larger remainder in *Tankah Siáh*,† an exceptional association of cur-

\* This coin is similar, but not identical in its legends with the gold piece, No. 84, of 736 A. H., p. 50 Pathán Sultáns. The following are the inscriptions:

Obverse—والله الغني وانتم الفقرا

• Reverse—في عهد محمد بن تغلق

Margin—بدار الاسلام سنة اربع وثلثين وسبعماية

† Báber has left an interesting account of the revenues of his newly-acquired kingdom in India, as estimated after the battle of Panipat, in A. H. 932, to the effect that "the countries from Bhíra to Bahár which are now under my dominion yield a revenue of 52 krores" of Tankahs. In the detail of the returns from different provinces, Tírhút is noticed as Tribute (Khidmatána) of the Tírhúti Rajah 250,000 *tankah nukrah*, and 2,750,000 *tankah sídh*. William Erskine, History of India under Báber and Humáyun, London, 1854, vol. i., p. 540. See also Leyden's Memoirs of Báber, London, 1826, p. 334.

rencies in a given locality, which can scarcely be explained in a more simple and reasonable manner than by assuming the lower description of the conventional estimate piece to have been concurrent with a better description of the same coin, constituting the prevailing and authorized revenue standard of the northern portions of the conquering Moghul's Indian dominions.

Another important element of all currency questions is the relative rate of exchange of the precious metals *inter se*. And this is a division of the enquiry of peculiar significance at the present moment, when Her Majesty's Government are under pressure by the European interest to introduce gold as a legal tender at a fixed and permanent rate, or, in effect, to supersede the existing silver standard, the single and incontestable measure of value, in which all modern obligations have been contracted, and a metal, whose present market price is, in all human probability, less liable to be affected by over production than that of gold: the bullion value of which latter had already begun to decline in the Bazárs of India, simultaneously with the arrival of the first fruits of Australian mining.

If the contemplated authoritative revolution in the established currency had to be applied to a fully civilized people, there might be less objection to this premature experiment; but to disturb the dealings of an empire, peopled by races of extreme fixity of ideas, to give advantages to the crafty few, to the detriment of the mass of the unlettered population, is scarcely justified by the exigencies of British trade, and India's well-wishers may fairly advance a mild protest against hasty legislation, and claim for a subject and but little understood Nationality, some consideration before the ruling power forces on their unprepared minds the advanced commercial tenets of the cities of London and Liverpool.

The ordinary rate of exchange of silver against gold in Marco Polo's time (1271-91 A. D.),\* may be inferred to have been eight to one;

\* The Province of KARAIAN. "For money they employ the white porcelain shell found in the sea, and these they also wear as ornaments about their necks. Eighty of the shells are equal in value to a *saggio* of silver, or two Venetian groats, and eight *saggi* of good silver to one of pure gold." Chap. xxxix.

The Province of KARAZAN. "Gold is found in the rivers, both in small particles and in lumps; and there are also veins of it in the mountains. In consequence of the large quantity obtained, they give a *saggio* of gold for six *saggi* of silver. They likewise use the before-mentioned porcelain shells in currency, which, however, are not found in this part of the world, but are



though exceptional cases are mentioned in localities within the reach of Indian traders, where the ratios of six to one and five to one severally obtained.

Ibn •Batutah, in the middle of the fourteenth century, when he was, so to say, resident and domesticated in India, reports the relative values of the metals as eight to one.\*

brought from India."—Chap. xl. ; also Pinkerton (London, 1811), vol. vii., 143.

The Province of KARDANDAN. "The currency of this country is gold by weight, and also the porcelain shells. An ounce of gold is exchanged for five ounces of silver, and a saggio of gold for five saggi of silver; there being no silver mines in this country, but much gold; and consequently the merchants who import silver obtain a large profit." Chap. xli.

The Kingdom of MIEN (*Ava*). "You then reach a spacious plain [at the foot of the Yunnan range], whereon, three days in every week, a number of people assemble, many of whom come down from the neighbouring mountains, bringing their gold to be exchanged for silver, which the merchants who repair thither from distant countries carry with them for this purpose; and one saggio of gold is given for five of silver." Chap. xliii. Travels of Marco Polo, by W. Marsden, London, 1818; and Bohn's Edition, 1854.

رايت الارز يباع في اسواقها خمسة و عشرين رطلا دهلية بدينار فضى \*

الدينار الفضى هو ثمانية دراهم و درهمهم كالدار هم النقرة سواء iv. 10.

"J'ai vu vendre le riz, dans les marchés de ce pays [Bengale], sur le pied de vingt-cinq rithl de Dihly pour un dinar d'argent: celui-ci vaut huit drachmes, et leur drachme équivaut absolument à la drachme d'argent." (iv. 210.)

The difficulty of arriving at any thoroughly satisfactory interpretation of the obscure Arabic text, as it now stands, may be frankly admitted, nor do I seek to alter or amend the French translation, further than to offer a very simple explanation of what probably the author really designed to convey in the general tenor of the passage in question. It was a crude but established custom among the early Muhammadan occupying conquerors of India, to issue gold and silver coins of equal weights, identical fabric, and analogous central legends; hence, whenever, as in the present instance, the word *Dinār* is used in apposition with and contrast to the secondary term *Dirham*, the one *primā facie* implies gold, the other silver; and there can be little doubt but that the original design of the text was to specify that one gold piece of a given weight passed *in situ* for eight silver pieces in similar form and of slightly greater bulk. It is possible that the term *Dinār* may in process of time have come to stand for a conventional measure of value, like the "pound sterling," susceptible by common consent of being liquidated in the due equivalent of silver; but this concession need not affect the direct contrast between the *Dinār* and *Dirhams* so obviously marked in the case in point.

Ibn Batutah, in an earlier part of his work (iii. 426), [Lee's edition is imperfect at this portion, p. 149] gives us the comparative Delhi rate of exchange—of which he had unpleasant personal experiences: he relates that he was directed to be paid  $(55,000 + 12,000 =) 67,000$  pieces of some well understood currency, neither the name or the metal of which is defined, but which may legitimately be taken to have been "Silver Tankahs," and in satisfaction of this amount, deducting the established one-tenth for *Dastūr*, which left a reduced total of 60,300, he received 6,233 gold tankahs. Under this scale of payment the gold must have borne a rate of exchange of one to 9.67 of silver, or very nearly one to 10, a proportion which might be supposed to clash with the one to eight of the more southern kingdom, but the existing state of the currencies of the two localities afford a striking illustration of the consistency

The Emperor Akbar's minister, Abūl Fazl, has left an official record of the value of gold in the second half of the sixteenth century, at which period the price was on the rise, so that the mints were issuing gold coin in the relation of one to 9.4 of silver. But a remarkable advance must have taken place about this time, as in the second moiety of the seventeenth century, Tavernier\* found gold exchanging against fourteen times its weight of silver, from which point it gradually advanced to one to fifteen, a rate it maintained when the East India Company re-modelled the coinage in 1833.†

of the African observer's appreciation of money values in either case. His special patron, Muhammad bin Tughlak, Emperor of Dehli, had, from his first elevation to the throne, evinced a tendency to tamper with the currency, departing very early in his reign from the traditional equality of weights of gold and silver coins; he re-modelled both forms and relative proportions, introducing pieces of 200 grains of gold, styled on their surfaces *dīnārs*, and silver coins of 140 grains, designated as *adalis*, in supersession of the ancient equable tankahs, both of gold and silver, extant examples of which in either metal come up to about 174 grains. More important for the present issue is the practical result, that, from the very commencement, Muhammad Tughlak's silver money is invariably of a lower standard than that of his predecessors, whether this refers to the early continuation of the full silver tankah, or to his own newly devised 140 grain piece, a mere reproduction of the time-honoured local weight, which the Aryan races found current in the land some twenty-five centuries before this Moslem revival; but in either case, this payment to Ibn Batutah seems to have been made after the Sultan had organised and abandoned that imaginary phase of perfection in the royal art of depreciating the circulating media, by the entire supersession of the precious metals, and following the ideal of a paper currency, the substitution of a copper simulacrum of each and every piece in the order of its degree from the *Dīnār* to the lowest coin in the realm, the values being authoritatively designated on the surface of each. This forced currency held its own, more or less successfully, from 730 to 733, when it came to its simple and self-developed end. Taking the probable date of this payment as 742-3 A. H. (Ibn B. vi., p. 4, and vol. iii., p. xxii.), it may be assumed that the 174 (or 175) grain old gold tankah, which had heretofore stood at the equitable exchange of one to eight tankahs of good silver, came necessarily, in the depreciation of the new silver coins, to be worth ten or more of the later issues. Pathan Sultans, p. 53).

\* "All the gold and silver which is brought into the territories of the Great Mogul is refined to the highest perfection before it be coined into money."—Tavernier, London Edition, 1677, p. 2. "The roupie of gold weighs two drams and a half, and eleven grains, and is valued in the country at 14 roupies of silver."—Page 2. "But to return to our roupies of gold, you must take notice that they are not so current among the merchants. For one of them is not worth above fourteen roupies." The traveller then goes on to relate his doleful personal experiences, of how, when he elected to be paid for his goods in gold, "the king's uncle" forced him to receive the gold rupee at the rate of fourteen and a half silver rupees, whereby he lost no less than 3428 rupees on the transaction. Sir James Stewart, writing in 1772, also estimates the conventional proportionate value of silver to gold, as fourteen to one—"The Principles of Money applied to the present state of the Coin of Bengal." Calcutta, 1772.

† Prinsep's Useful Tables, pp. 5, 72, 79.

Afterwards, with prospering times, the metal ran up occasionally to fabulous premiums, to fall again ignominiously when Californian and Australian discoveries made it common in the land.

I revert for the moment to a more formal recapitulation of the computations, which serve to establish the ratios of gold and silver in Akbar's time.

Aból Fazl's figured returns give the following results :—

First.—Chugal, weight in gold Tolah 3, Másha 0, Rati  $5\frac{1}{4}=30$  Rs. of  $11\frac{1}{2}$  Máshas each :  $549.84 : 172.5 \times 30$  (5175.0) : 1 : : 9.4118.

Second.—Áftábí, gold, weight t. 1, m. 2, r.  $4\frac{1}{4}=12$  Rs. : 218.90 : :  $172.5 \times 12$  (2070.0) : 1 : : 9.4563.

Third.—Ílahí, or Lál Jalálí, also Muíanni, gold, weight m. 12, r.  $1\frac{3}{4}=10$  Rs. : 183.28 : :  $172.5 \times 10$  (1725.0) : 1 : : 9.4118.

3 A.—The larger piece, the Sihansah, in value 100 Lál Jalálís, gives an identical return. Weight in gold, t. 101, m. 9, r. 7 = 1000 Rs. : 18328 : :  $172,500$  ( $172.5 \times 100 \times 10$ ) : 1 : : 9.4118.

Fourth.—Adl-Gutkah, or Muhar, also called Mahrábí, gold, weight 11 Máshas = 9 Rs. : 165 : :  $172.5 \times 9$  (1552.5) : 1 : : 9.40909.

4 A.—The higher proportions specified under the piece of 100 round Muhars, produce a similar result. Weight in gold, t. 91, m. 8 = 900 Rs. : 16500 : :  $155250$  ( $172.5 \times 100 \times 9$ ) : 1 : : 9.40.

These sums are based upon the ordinary Tolah of 180 gr., Másha of 15, and Rati of 1.875 grs. The question of corresponding values in the English scale need not affect the accuracy of comparisons founded upon the conventional measure by which both metals were estimated.

I have given more prominence to the above calculations, and even tested anew my earlier returns by the independent totals afforded by the larger sums now inserted, because the obvious result of gold being to silver as one to 9.4, has been called in question by an official of the Calcutta Mint (a Dr. Shekleton), who, however, while unable either to correct my data, or to produce any possible evidence against my conclusions, ventures to affirm, that "9.4 to one is a relative value of gold to silver, which never could really have existed."\* Nevertheless, here is a series of comparative weights and values, furnished by the highest authority of the day, and each and all pro-

\* Jour. As. Soc. Bengal, 1864, p. 517.

duce returns absolutely identical up to the first place of decimals. My original estimates were sketched and published at Dehli, in 1851, where I had access to the best MSS., to the most comprehensive range of antiquarian relics, and at command the most intelligent oral testimony in the land. When reprinting Prinsep's "Useful Tables" (London, 1858), I had occasion to quote these calculations, and was able to fortify them, had it been needed, by the precisely analogous results obtained by Colonel W. Anderson, who had tried Abúl Fazl's figures, from a different point of view, and for altogether independent purposes.\* But if there were the faintest reason for doubting so moderate a rate as one to 9·4, the whole discussion might be set at rest by Abúl Fazl's own statement as translated into English in 1783 when, in concluding a very elaborate review of the profit and loss of refining gold, for the purpose of coinage, he concludes, and the process "leaves a remainder of about *one-half a tolah* of gold, the value of which is four rupees."† It may be as well that I should add, that some of my totals differ from those to be found in Gladwin's translation of the original Persian text.‡ I do not recapitulate the several divergencies, but it is necessary to prove the justice of one, at least, of my emendations. Gladwin's MSS. gave the rupee at  $11\frac{1}{2}$  *máshas*, (i. p. 34). The more carefully collated Dehli texts showed the real weight to be 11·5 *máshas*, a static fact of some importance, which is curiously susceptible of proof from Gladwin's own data: at page 46 of his Calcutta edition, a sum is given of the refining charges and profits, as understood by the mints of those days, wherein 989 tolas, 9 *máshas* of impure silver is stated to be reduced by 14 t. 9 m. 1 r. in refining, and a further 4 t. 10 m. 3 r. in manipulation, leaving 11641 *máshas* of silver (989. 9. 0. — 14. 9. 1. — 4. 10. 3. = 11641) which is officially announced as ordinarily coined into 1012 rupees, ( $1012 \times 115 = 11638$ ) giving, as nearly as may be, the essential  $11\frac{1}{2}$  *máshas*, which the translated text *should* have preserved in its earlier passages.

\*

Richard Hawkins, who was at Agra in A. D. 1609-11, during the reign of Jahángír, has left a notice of certain accumulated treasures of that prince which he was permitted to behold, and amongst the rest he specifies, "In primis, of Seraffins Ecberi, which be ten rupias

\* U. T., Vol. ii., p. 32.

† Gladwin, i. 44.

‡ 4to., Calcutta, 1783.

apiece;" to this passage is added in a marginal note, that, "a tole is a rupia challany [current] of silver, and ten of these toles are of the value of one of gold."\* This evidence might at first sight seem to militate against the conclusion arrived at from the official returns above summarized, but the value of gold was clearly on the rise, and one of the aims of Akbar's legislation on metallic exchanges, which had necessarily been disturbed by progressive modifications in the relative values of the precious metals, was manifestly to secure an authoritative *even* reckoning by tens and hundreds. The old round *muhar*, (No. 4 of the above list) represented the inconvenient sum of nine rupees, or 360 *dáms*; by raising the weight of the piece to the higher total given under No. 3, the gold *ilahí* was made equivalent to ten rupees, or in fiscal reckoning to 400 *dáms*. Similarly, in the case of the silver coin, the old rupee passed for 39 *dáms*, in the new currency a value of 40 *dáms* was secured, not by an increase of weight, but by the declared and doubtlessly achieved higher standard of the metal employed, aided by the advantage that contemporary mintages so readily secured in India.

The subdivisions of the standard silver Tankah, as well as the relative exchange ratios of silver and copper in their subordinate denominations, claim a passing notice. Though Bengal proper probably remained satisfied with its lower currency of cowries, supplemented by the occasional intervention of copper, for some time after the introduction of gold and silver money, yet as the earliest copper coins of that kingdom must have been based upon and, in the first instance, supplied by Dehli mintages, the Imperial practice comes properly within the range of the local division of the general enquiry.

It has been seen that Minháj-ul-Siráj, in comparing the circulating media of Hindustán and Bengal, speaks of the currency of the former as composed of *Chitals*, a name which is seemingly used by himself and succeeding authors in the generic sense for money, as if these pieces continued to constitute the popular standard both in theory and practice, notwithstanding the introduction of the more imposing *tankahs* of gold and silver. Up to this time it has not been possible satisfactorily to demonstrate the actual value of the coin in question; in some cases indirect evidence would seem to bring its intrinsic worth down to a very low point, while at times the money calcula-

\* Purchas' Travels, folio, 1625-26, i. 217.

tions for large sums, in which its name alone is used, appear to invest it with a metrical position far beyond the subordinate exchanges of mere bazár traffic.

In the details of the "prices-current" in the reign of Alá'ud-din Muhammad, as well as in the relation of certain monetary re-adjustments made by Firúz Sháh III., the name of the *Chital* is constantly associated in the definition of comparative values with another subdivision entitled the *Káñi*, which may now be pronounced with some certainty to have been the  $\frac{1}{4}$  of the original *Tankuh*, of 175 grains, and  $\frac{1}{6}$  of the new silver coin of 140 grains, introduced by Muhammad bin Tughlak. The temporary forced currency of this Sultán necessitated in itself the positive announcement of the names and authoritative equivalents of each representative piece, and this abnormal practice contributes many items towards the elucidation of the quantitative constitution of the real currency of the day, which these copper tokens were designed to replace. In illustration of this point, I insert a woodcut and description of a brass coin, which was put forth to pass for the value of the silver piece of 140 grains, to whose official weight it is seemingly suggestively approximated.



Brass; weight, 132 grs.; A. H. 731; *Common*.  
*Obverse*.—مهرشده تانكه پنجاه كاني در روزگار اميدوار محمد تغلق Struck (lit. *sealed*), a tankah of fifty kánis in the reign of the servant, hopeful (of mercy), Muhammad Taghlak.

*Reverse*.—Area, الرحمن من اطاع السلطان فقد اطاع. "He who obeys the king, truly he obeys God."\*

Margin, در تخت كاه دولت اباد شال برهفصد مي يك. At the capital Daulat-ábád, year? 731.

In addition to this 50 káni-piece may be quoted extant specimens of this Sultán's forced issues, bearing the definitive names of "*hastkáni*" (8 kánis). "*Shash-káni*." (6 kánis) and "*Do-káni*" (2 kánis.) An obverse of the latter is given in the margin. The reverse has the unadorned name of محمد تغلق.



\* In other examples of the forced currency, he exhorts his subjects in more urgent terms to submit to the Almighty, as represented in the person of the ruling monarch, and to adopt, in effect, the bad money he covers with texts from the Kurán—the "Obey God and obey the Prophet and those in authority among you," and "Sovereignty is not conferred upon every man," but "some" are placed over "others"—were unneeded on his coinage of pure metal.

Next in order, may be quoted historical evidence of Fīrūz Shāh's fiscal re-organizations, in the course of which mention is made of pre-existing pieces of 48, 25, 24, 12, 10, 8, and 6 kánis, the lowest denomination called by that name; afterwards the narrative goes on to explain that, in addition to the ordinary *Chital* piece already in use, Fīrūz Shāh originated, for the benefit of the poorer classes of his subjects, subdivisinal  $\frac{1}{2}$  Chital and  $\frac{1}{4}$  Chital pieces.

As the spoken languages of the Peninsula enables us to restore the true meaning to the misinterpreted Sanskrit *karsha*,\* so the Dravidian tongues readily explain the term *káni*, which finds no place in Aryan vocabularies, but which was incorporated into the vernaculars of Hindustán, during the southward migrations of the Scythic tribes. In Telugu, *káni* means  $\frac{1}{64}$ , or one quarter of a sixteenth" (Brown). In Canarese  $\frac{1}{64}$  (Reeve), and in Tamil  $\frac{1}{60}$  (Winslow). Wilson's Glossary gives "*Káni*, corruptly, *Cawney*. Tel. Tam. Karn.  $\frac{1}{60}$ , or sometimes  $\frac{1}{64}$ ."†

The term *káni*, in addition to its preferable meaning of  $\frac{1}{64}$ , was, as we see, also used for the fraction  $\frac{1}{60}$ , but its application in the former sense to the ruling integer in the present instance, seems to be conclusively settled by the relative proportions assigned to the modified *tankah* of Muhammad bin Tughlak, when compared with the normal weight of the earlier coin (: 64 :: 175 : 50 :: 136·718).

The method in which the subdivisinal currency was arranged, consisted, as has already been stated, of an admixture of the two metals, silver and copper, in intentionally varying proportions in pieces of identical weight, shape and device; so that the traders in each case had to judge by the eye and hand of the intrinsic value of the coin presented to them. To European notions this system would imply endless doubt and uncertainty, but under the practised vision and delicate perceptive powers of touch, with which the natives of India are endowed, but little difficulty seems to have been experienced; and I myself can testify to the accuracy of the verdicts pronounced by the experienced men of Delhi, whose instinctive estimates were tested repeatedly by absolute assay. I published many of these

\* Num. Chron. iv. 58; J. A. S. B. xxxiii. 266.

† There is a coin called a "Do-gáni or Doodée," still quoted in the Madras Almanacks.

results, some years ago, in the Numismatic Chronicle,\* where the curious in these matters may trace many of the gradational pieces of the *kānis* above enumerated. As some further experiments in reference to the intrinsic values of these coins were made, at my instance, in the Calcutta Mint, I subjoin a table of the authoritative results, which sufficiently confirms the previous less exhaustive assays by the native process.

### LIST OF DEHLI COINS,

*Composed of Silver and Copper in varying proportions, forwarded for examination by Edward Thomas, Esq., C. S., 10th June, 1853.*

| No. of Packet. | A. H. | Reference to Numbers of Coins in "Pathán Sultans." | No. of Coins in Parcel. | Weight in Grains. | Dwts. Fine Silver per lb. in each. |
|----------------|-------|----------------------------------------------------|-------------------------|-------------------|------------------------------------|
| 1              | 716   | Mubarak Sháh. No. 66.                              | 1                       | 53.22             | 5.375                              |
| 2              | 726   | Muhammad bin Tughlak. No. 91.                      | 1                       | 55.15             | 13.300                             |
| 3              | 895   | Sikandar Bahlol. No. 163.                          | 1                       | 143.438           | 1.900                              |
| 4              | 896   | " "                                                | 4-1                     | 142.963           | 2.025                              |
| "              | "     | " "                                                | 1                       | 142.936           | 1.925                              |
| "              | "     | " "                                                | 1                       | 138.913           | 1.615                              |
| "              | "     | " "                                                | 1                       | 140.088           | 2.200                              |
| 5              | 898   | " "                                                | 1                       | 141.500           | 1.5625                             |
| 6              | 900   | " "                                                | 2-1                     | 140.800           | 2.6000                             |
| "              | "     | " "                                                | 1                       | 127.600           | 3.0125                             |
| 7              | 903   | " "                                                | 1                       | 143.100           | 4.650                              |
| 8              | 904   | " "                                                | 3-1                     | 142.500           | 5.624                              |
| "              | 907   | " "                                                | 3-1                     | 143.250           | 15.5                               |
| "              | "     | " "                                                | 1                       | 141.150           | 16.0                               |
| "              | "     | " "                                                | 1                       | 139.900           | 16.0                               |
| 9              | 905   | " "                                                | 1                       | 144.500           | 17.5                               |
| 10             | 909   | " "                                                | 1                       | 141.500           | 15.0                               |
| 11             | 910   | " "                                                | 1                       | 140.200           | 15.0                               |
| 12             | 912   | " "                                                | 2-1                     | 142.500           | 12.0                               |
| "              | "     | " "                                                | 1                       | 135.500           | 15.0                               |
| 13             | 913   | " "                                                | 2-1                     | 132.250           | 15.0                               |
| "              | "     | " "                                                | 1                       | 140.750           | 15.0                               |
| 14             | 914   | " "                                                | 4-1                     | 140.000           | 15.0                               |
| "              | "     | " "                                                | 1                       | 138.500           | 15.5                               |
| "              | "     | " "                                                | 1                       | 141.000           | 13.5                               |
| "              | "     | " "                                                | 1                       | 140.500           | 16.0                               |
| 15             | 918   | " "                                                | 4-1                     | 138.250           | 10.0                               |
| "              | "     | " "                                                | 1                       | 133.250           | 10.0                               |
| "              | "     | " "                                                | 1                       | 139.750           | 9.0                                |
| "              | "     | " "                                                | 1                       | 125.000           | 8.0                                |
| 16             | 919   | " "                                                | 3-1                     | 135.250           | 32.0                               |
| "              | "     | " "                                                | 1                       | 137.250           | 8.0                                |
| "              | "     | " "                                                | 1                       | 137.500           | 8.0                                |

\* Vol. xv. 1852, p. 121, *et seq.*



The Institutes of Manu have preserved a record, reproduced in the subjoined table, of the various weights in use, some centuries before Christ,\* and among other things explain, that the values of gold and copper were calculated by a different metric scheme, to that applied to silver. A larger number of Ratis went to the Másha in the former, and the progression of numbers commenced with a five ( $5 \times 16$ ), while the silver estimates were founded on the simple arithmetic of *fours* ( $2 \times 16$ ), which constituted so special a characteristic of India's home civilization. Still, the two sets of tables, starting from independent bases, were very early assimilated and adapted to each other in the advancing totals, so that the 320 ratis constituting the *satamána* of the quarternary multiplication, is created in the third line by the use of a *ten*, and the quasi exotic scheme corrects its independent elements by multiplying by *four*, and produces a similar total in the contents of the *Pala* or *Nishka*. The second lines of the tables are severally filled in with the aggregate numbers, 32 and 80, and as the duplication of the former, or 64, has been seen to

\* Manu. viii. 131.—“Those names of copper, silver, and gold (weights) which are commonly used among men for the purpose of worldly business, I will now comprehensively explain. 132.—The very small mote which may be discerned in a sunbeam passing through a lattice is the first of quantities, and men call it a *trasareṇu*. 133.—Eight of those *trasareṇus* are supposed equal in weight to one minute poppy-seed (*liksha*), three of those seeds are equal to one black mustard-seed (*rajasarshapa*), and three of these last to a white mustard-seed (*gaura-sarshapa*). 134.—Six white mustard-seeds are equal to a middle-sized barley-corn (*yava*), three such barley-corns to one *krshnala* [*raktika*], five *krshnalas* of gold are one *másha*, and sixteen such *máshas* one *suvarna*. 135.—Four *suvarnas* make a *pala*, ten *palas* a *dharana*, but two *krshnalas* weighed together are considered as one silver *máshaka*. 136.—Sixteen of those *máshakas* are a silver *dharana* or *purána*, but a copper *kársha* is known to be a *pana* or *karshapana*. 137.—Ten *dharanas* of silver are known by the name of a *satamána*, and the weight of four *suvarnas* has also the appellation of a *nishka*.” These statements may be tabulated thus as the

#### ANCIENT INDIAN SYSTEM OF WEIGHTS.

| SILVER.  |   |               |                              |                           |
|----------|---|---------------|------------------------------|---------------------------|
| 2 ratis  | = | 1 másha       |                              |                           |
| 32 „     | = | 16 „          | = { 1 dharana,<br>or purána. |                           |
| 320 „    | = | 160 „         | = 10 „                       | 1 satamána.               |
| GOLD.    |   |               |                              |                           |
| 5 ratis  | = | 1 másha.      |                              |                           |
| 80 „     | = | 16 „          | = 1 suvarna.                 |                           |
| 320 „    | = | 64 „          | = 4 „                        | = { 1 pala, or<br>nishka. |
| 3200 „   | = | 640 „         | = 40 „                       | = 10 „ = 1 dharana        |
| COPPER.  |   |               |                              |                           |
| 80 ratis | = | 1 kárshapana. |                              |                           |


do duty in the case, the probability of the use of the 160 naturally suggests itself in connexion with the theoretical organization of the copper coinage.

In proceeding to test the relations of the minor and subordinate currencies, the cardinal point to be determined is, the exchangeable value of copper as against silver. It has been affirmed by Colebrooke,\* that the ratio stood in Manu's time at 64 to 1: accepting the correctness of this estimate, which has, I believe, remained unchallenged, and supposing the rate to have remained practically but little affected up to the Muhammadan conquest, the 175 grains of *silver* of Altamsh's new coinage would be equivalent in metallic value to 11,200 grains of *copper*. The ancient copper *kārshāpana* is recognised and defined as 80 *ratis* in weight, so that under the above conditions, and calculating the *rati* at 1.75 grains, each *kārshāpana* was equal to 140 grains, and eighty of these, under the same calculations, give a return of 11,200 grains. Without at present advancing any more definite proposition, or quoting dubious coincidences, it may be as well to test these preliminary results by the Numismatic data Fīrūz Shāh's Mints have left as an heritage behind him. Among the incidents quoted regarding that monarch's monetary innovations he is stated to have introduced, for the first time, *half* and *quarter* Chittals. On the occasion of a very elaborate revision of my monograph on the Pathān Sultāns of Dehli, while residing under the very shadow of so many of their memorial edifices, I acquired and described, among others, two specimens of the money of this king, which seemed to be closely identifiable with his Utopian productions of new and infinitesimal subdivisions of the leading copper coinage, in his expressed desire of securing for the poorest of the poor, the fractional change they might be entitled to in the most limited purchases.† These coins responded singularly in their mutual proportions, and contributed in the form of once current money, definitive weights in copper amounting severally to 34.5 and 17.8 grains, from which a very low estimate was deduced of 34.8 and 17.4, as a normal official standard.

\* As. Res. v. 95.

† Shams-i-Sirāj, in his work entitled the *Tārikh-i-Fīrūz Shāhi*, gives the following incidents regarding Fīrūz Shāh's coinages:—

شرح بیان احوال سکہ مهر شش گانے نکلت سلطان فیروزشاہ در

If the 34.8 grain of the first of these be multiplied by 160, it will give a return of 5568.0 grains, and accepting this trial piece, conditionally, as Firúz's novel *half-Chital*,\* it will be seen to furnish a general total of 11136 grains for the copper equivalent of.   $\frac{1}{2}$  Chital of Firúz.  
the 175 grains of silver contained in the old Tankah, and confirms the range of the Chital at 69.6 grains, or only .4 short of the full contents tradition would assign it, as the unchanged *half-kārshāpana* of primitive

طور عظمت و دور مکنث خویش چون سلاطین اهل گیتی سکھاء  
بچندین نوع پدید آورد چنانچه زر تنگه و نقره و سکه چهل و هشت  
گانه و مهر بیست و پنجگانه و بیست و چهار گانه و دوازده گانه و ده گانه و  
هشتگانه و ششگانه و مهر یک جیتل چون فیروزشاه بچندین اجناس  
بی قیاس مهر وضع کردند بعد از در دل مبارک بالهام حضرت حق  
تبارک تعالی گذرانید اگر بیچاره فقیران از اهل بازار چیزی  
خرید کنند و از جمله مال نیم جیتل و یا دانگی باقی ماند آن  
دوکاندار دانکه خود ندارد اگر این راه گذاری آن باقی بر او بگذارد  
ضایع رود اگر ازان دوکاندار طلب کند چون این مهر نیست از  
کجا چه دهد باقی او دهد برین وجوه میان باج و مشتری مخالفت  
این حالت بتطویل کشید سلطان فیروزشاه فرمان فرمود که مهر  
نیم جیتل که انرا اده گویند و مهر دانک جیتل که انرا پنکه گویند  
وضع کنند تا غرض فقوا و مساکن حاصل شود

The original and unique MS., from which the above passage is extracted, is in the possession of the Nawáb Zia-ud-din of Loháru, in the Dehli territory.

\* I once supposed these two coins to be whole and half Chitals, instead of the half and quarter pieces now adopted.

† It may be as well to state distinctly that the most complete affirmation of the numismatic existence of a *Chital* of a given weight and value, supported even by all anterior written testimony, in no wise detracts from the subsequent and independent use of the name for the purposes of account, a confusion which perchance may have arisen from the traditional permanency of the term itself, which in either case might eventually have been used to represent higher or lower values than that which originally belonged to it. Zia-i-Barni at one moment seems to employ the term as a fractional fiftieth of the *Tankah*, while in other parts of the same or similar documents he quotes a total of "sixty Chitals," and in his statement of progressive advances of price, mentions the rise from twenty Chitals to *half a Tankah*. Ferishtah following, with but vague knowledge, declares that fifty Chitals constituted the *Tankah*; while Abul Fazl, who had real information on these matters as understood in his own day, asserts that the *dám* was divided "in account" into twenty-five Chitals. (See Suppt. Páthan Sultáns, p. 31; N. C. xv. 156; Ferishtah, p. 299; Gladwin A. A., I., p. 36.) Then again there seems to have been some direct association between *Chitals* and *Kánis*, as General Cunningham has published a coin which he as yet has only partially deciphered, bearing the word چنله on the one side, and [یکانی] on the other. J. A. S. B., 1862, p. 425.

ages.† To pass to the opposite extreme for a test of the copper exchange rate, it is found that when Shír Sháh reorganised the northern coinage of Hindustán, by the lights of his southern experience, and swept away all dubious combinations of metals, reducing the copper standard to its severe chemical element; his Mint statistics show that the 178 grains of silver, constituting his revised Tankah, exchanged against 40 *dáms*, or double chitals of copper, of an ascertained quadrupled weight of 323.5 grains each, producing in all a total of 12,040 grains of the latter metal, as the equivalent of 178 grains of silver, or in the ratio of 72.69 to 1; though, even in the altered weights and modified proportions, still retaining inherent traces of the old scheme of *fours*, in the half *dám* of 80, and the quarter *dám* of 160 to the new "Rupee."

It remains to discover upon what principles the new silver coinage of Altamsh was based. That copper was the ruling standard by which the relative values of the more precious metals were determined, there can scarcely be a doubt. The estimate by Panas of the ancient Lawgiver, the constant reckoning by Chitals of the early Muhammadan intruders, down to the revenue assessments of Akbar, all of which were calculated in copper coin, sufficiently establish the permanency of the local custom, and the intrinsic contents of Altamsh's *Sikkah* or الفضة of 174 or 175 grains, must primarily have been regulated by the silver equivalent of a given number of Chitals. Had the old silver *Purána* been still in vogue, the new coin might have been supposed to have been based upon their weights and values; three of which *Puránas* would have answered to an approximate total of 96 ratis; but although the weight of the old coin had been preserved in the more modern *Dehli-wálas*, the metallic value of the current pieces had been so reduced, that from 16 to 24 would probably have been required to meet the exchange against the original silver *Tankah*; on the other hand, although the number of 96 ratis does not occur in the ancient tables, the combination of the inconvenient number of three *Puránas* into one piece, is by no means opposed to Vedic ideas; and there can be no question but that the traditional 96 ratis, of whatever origination, is constant in the modern *tolah*; but, as I have said before, the question whether the new coin was designed to constitute an even one hundred rati-piece, which, in process of time, by wear or inten-

tional lowering of standard weights, came to settle down to the 96 *rati tolak*, remains to be proved by the determination of the decimals in troy-grains, which ought to be assigned to the normal *rati*.

I now proceed to notice the historical bearings of the coins of the Bengal series.

Any general revision of a special subject, coincident with the discovery of an unusually large amount of new illustrative materials, owes a first tribute to previous commentators—whose range of identification may chance to have been circumscribed by more limited archaeological data, the application of which may equally have been narrowed by the inaccessibility of written history, heretofore confined, as in the present instance, to original Oriental MSS., or the partial transcripts and translations incidentally made known to the European world. At the head of the list of modern contributors must be placed, in point of time, M. Reinaud, who, so long ago as 1823, deciphered and described several types of the Bengal Mintages, commencing with those of Ilías Sháh (No. viii. of this series).<sup>\*</sup> Closely following appeared Marsden's elaborate work, which, among other novelties, displayed a well-sustained sequence of Bengal coins, with corresponding engravings, *still unequalled*, though in point of antiquity producing nothing earlier than the issues of the same Ilías Sháh, who had inaugurated the newly-asserted independence of the southern monarchy, with such a wealth of coinages.<sup>†</sup> Next in order must be cited a paper, in the *Journal of the Asiatic Society of Bengal*, by Mr. Laidlay, which added materially to the numismatic records of the local sovereigns, though still remaining deficient in the development of memorials of the more purely introductory history of the kingdom.<sup>‡</sup> I myself, in the course of the publication of the *Imperial Coins of the Pathán Sultáns of Dehli*,§ had occasion to notice two pieces of Bahádur Sháh, one of which proved of considerable interest, and likewise coins of both Shams-ud-dín Fírúz, and Mubárák Sháh, whose defective marginal legends, however, defeated any conclusive assignment to their original producers.

<sup>\*</sup> *Journal Asiatique*, Paris, vol. iii., p. 272.

<sup>†</sup> *Numismata Orientalia*, London, 1825, pp. 561-585.

<sup>‡</sup> Vol. xv. (1846), p. 323.

<sup>§</sup> Wertheimer, London, 1847, pp. 37, 42, 82, and Supplement printed at Delhi in 1851, p. 15. See also *Numismatic Chronicle*, vol. ix., pp. 176, 181; vol. x., p. 153; and vol. xv. p. 124.

The chronicles of a subordinate and, in those days, but little accessible country were too often neglected by the national historians at the Court of Dehli, even if their means of information as to the course of local events had not necessarily been more or less imperfect. Two striking exceptions to the ordinary rule fortuitously occur, at conjunctions specially bearing upon the present enquiry, in the narratives of Minháj-ul-Siráj, Juzjáni, and the "Travels of Ibn Batutah," the former of whom accompanied Tughán Khán to Lakhnauti, in A. H. 640,\* where he resided for about two years. The Arab from Tangiers,† on his way round to China, as ambassador on the part of Muhammad bin Tughlak, found himself in Eastern Bengal at the inconvenient moment when Fakhr-ud-dín Mubárák was in a state of undisguised revolt against the emperor, to whom they jointly owed allegiance; but this did not interfere with his practical spirit of enquiry, or his placing on record a most graphic description of the existing civilization and politics of the kingdom, and further compiling a singularly fresh and independent account (derived clearly from *vivá voce* statements) of the immediately preceding dynastic changes to which the province had been subjected. So that, in effect, Ibn Batutah, with his merely incidental observations, has done more for the elucidation of the obscurities of the indigenous

\* The *Tabakát-i-Násiri* of Abú Umar Minháj-ud-dín bin Siráj-ud-dín, *Juzjáni*, has been printed and published in the Persian series of the *Bibliotheca Indica*, under the auspices of the Asiatic Society of Bengal (Calcutta, 1864, pp. 453.) The chapters on Indian and Central Asian affairs, with which the author was more or less personally conversant, have alone been reproduced. The usual Oriental commencement with the history of the world, the rise of Muhammadanism, etc., being mere compilations from secondary sources, have been very properly excluded from this edition. A full notice of the original work will be found in Mr. Morley's Catalogue of the MSS. of the R. A. S., p. 17 (London, 1854). Several other works of native historians, bearing upon the subject of this paper, have also been made accessible to the public in a printed form in the same collection, among which may be noted the *Tárikh-i-Firúz Sháhí* (the third king of the name in the Dehli list), by Zia-i-Barni (Calcutta, 1862, pp. 602), and the *Muntakhab-ul-Tawárikh* of Abd ul Kádir, *Buddáuni* (Calcutta, 1865, pp. 407). The editors have unadvisedly, I think, omitted the early portions of the original relating to India, and commence the publication with the accession of Akbar. An outline of the entire contents of the work will be found in Sir H. Elliot's *Historians of India* (Calcutta, 1849, p. 305).

† An English version of Ibn Batutah's *Travels* (taken from an abridged text), by Dr. S. Lee, was published in the series of the Oriental Translation Fund in 1829 (1 vol., 4to, London). A new and very complete edition of his entire Arabic Text, with a French Translation, chiefly the work of the late M. C. Defrémery, has been issued within the last few years by the *Société Asiatique* of Paris (4 vols. 8vo, Paris, 1853-1858).

history of the period represented by the earlier coins of the Kooch Bahár hoard, than all the native authors combined, to whose writings we at present have access.

The merits of these authors may or may not appear upon the surface in the subsequent pages, as it is only in doubtful or difficult cases that their aid may chance to be invoked, but for the obscure series of the first Governors of Bengal, the one stands alone; and for the space of time intervening between the provincial obscurity of Násir-ud-dín Mahmúd, the unambitious son of Balban, to the revival of public interest in Bengal, consequent upon the subjection and capture of a rebel Vassal by Ghíás-ud-dín Tughlak Sháh, the chance traveller describes more effectively the political mutations and varying monarchical successions than the professed historiographers treating exclusively of the annals of their own land.

The following list of Local Governors has been compiled, the early portion from the precise statements of Minháj-ul-Siráj, the latter part from the casual notices of Bengal, to be found in Zíá-i-Barni, who professed to continue the history of India from the latest date reached by the former author, or from A.H. 658 to 753, being a period of 95 years, covering the reigns of eleven kings. The last-named work was finally completed in A.H. 758.

The arrangement of the names and dates of accession of the chiefs will be found to depart occasionally from the details given by Stewart,\* in his excellent History of Bengal, but I have designedly sought to draw my materials independently from the original authorities, whom he was perhaps in a less favourable position for consulting than the student of the present day.

\* The History of Bengal, by Charles Stewart. London, 1813. 4to.

## GOVERNORS OF BENGAL.

| ACCESSION.<br>A.H. | NAMES OF GOVERNORS.                       | REMARKS.                                                                                                                                                                                                                                                          |
|--------------------|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 600                | 1. محمد بختیار خلجي                       | First Muhammadan conqueror of Bengal, under Kutb-ud-din of Delhi.                                                                                                                                                                                                 |
| 602                | 2. عز الدين محمد شيران خلجي               | Succeeds to the local government after the death of Muhammad Bakhtiyār.                                                                                                                                                                                           |
| 605                | 3. علاء الدين علي مردان خلجي              | Nominated to the government by Kutb-ud-din, on whose decease in A.H. 607, he assumes independence.*                                                                                                                                                               |
| 608                | 4. حسام الدين عوض خلجي (سلطان غياث الدين) | Commandant at Deokót, establishes his power and assumes royal honors. He submits to Altamsh in A.H. 622, but almost immediately commences an active revolt, which is put an end to in his capture by Násir-ud-din Mahmúd, the eldest son of Altamsh, in A.H. 624. |
| 624                | 5. ناصر الدين محمود بن سلطان التمش        | Násir-ud-din had been appointed by his father Governor of Oudh, in A.H. 623, from whence he advanced against Hisám ud-din in 624, and recovered the kingdom of Bengal, where he remained as sub-king till his death early in 626.                                 |
| 627                | 6. علاء الدين جاني                        | After temporary disturbances in the province, Altamsh, having restored order in A.H. 627, designated Alá-ud-din Jání to the charge of Bengal.                                                                                                                     |
|                    | 7. سيف الدين ايبك يغان نت                 | Nominated to Bengal on the dismissal of Alá-ud-din Jání (date not given). Dies in 631 A.H.                                                                                                                                                                        |

\* Minháj-ul-Siráj, who treats of the history of his own and immediately preceding times, introduces the reigns of the more powerful sovereigns with a full list of the Court notabilities, forming a sort of *Almanach de Gotha* of Muhammadan India. These lists embrace the various branches of the Royal Family, Ministers, Judges, and Governors of Provinces. The following names of the *مصاب*'s or military administrators of Bengal, which appear in the official returns, may serve to check or confirm the imperfect data obtained from the casual notices of local history to be met with in the general narrative of the events of the Empire at large. There is this discrimination, however, to be made that these imperial nominations were often merely titular, while the effective executive was in other and independent hands:

Under Altamsh, A.H. 607-633.

ملك لكهنوتي ملك اخيار الدين محمد برادر زاده

Under Násir-ud-din Mahmúd, A.H. 644-664.

الملك الكبير عز الدين طغرل طغان خان ملك لكهنوتي

الملك الكبير نور محمد خان قيران ملك اوده ولكهنوتي

الملك الكبير جلال الدين خان ملك جاني ملك لكهنوتي وكرة



## GOVERNORS OF BENGAL—continued.

| ACCES-<br>SION<br>A. H. | NAMES OF GOVERNORS.                  | REMARKS.                                                                                                                                                                                                                                                                                                                |
|-------------------------|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 631                     | 8. عزالدین طغرل طغان خان             | Pledges his allegiance to Riziah on her elevation in A. H. 634; continues in the Government till 642 A. H., when he surrenders the kingdom to No. 9. (Minhaj-ul-Siraj, the historian, was at his court at this latter period.                                                                                           |
| 642                     | 9. قمرالدین تمرخان قیران             | Obtains possession of Lakhnauti on the 5th Zul Kaa'd, A. H. 642—dies in 644.                                                                                                                                                                                                                                            |
|                         | 10. اختیار الدین یوزک طغرل خان.      | Dates uncertain. First appointed during the reign of Násir-ud-din Mahmúd of Dehlí. He seems to have been a powerful ruler and a daring commander, and finally met his death in his retreat from an over-venturesome expedition into Kámrúp. He had previously assumed independence under the title of سلطان مغیت الدین. |
| 656                     | 11. جلال الدین مسعود ملک جانی        | Appointed in A. H. 656. قتلخان (subsequently in temporary possession).                                                                                                                                                                                                                                                  |
| 657                     | 12. عزالدین بلبن اوزبکی              | Recognised, on receipt of his tributary presents at head-quarters, in the early part of A. H. 657.                                                                                                                                                                                                                      |
| 657                     | 13. تاج الدین ارسلان خان سدر خوارزمی | Obtains a momentary advantage over No. 12 in his absence from his Capital; eventually taken prisoner and superseded by No. 12.                                                                                                                                                                                          |
| 659                     | 14. (محمد ارسلان خان) تتر خان        | Son of No. 12.* On the accession of Balban in A. H. 664, he forwards elephants and tribute to Dehli.                                                                                                                                                                                                                    |
| 676?                    | 15. مغیت الدین طغرل                  | Appointed by Balban.† He afterwards asserts his independence, and assumes the title of سلطان مغیت الدین.<br><br>Balban sends armies against him without success, and at last proceeds in person to Bengal. Finally, Toghrul is surprised and killed.                                                                    |
| 681                     | 16. تتر خان ناصرالدین محمود          | Second son of Balban, installed with royal honors.                                                                                                                                                                                                                                                                      |

\* Zia-i-Barni in one place, page 53, calls him وئترخان پسر ارسلان محمد and again, at page 66, محمد ارسلان خان که اورا تتر خان گفتندی.

† Zia-i-Barni, pp. 82-92.

As I have such frequent occasion to quote the names of the Kings of the Imperial Dynasty of Dehli, I annex for facility of reference a full list of these Sovereigns.

## LIST OF THE PATHAN SULTANS OF HINDUSTAN.

(DEHLI).

| DATE OF<br>ACCESSION.<br>A. H. | NO. | NAMES OF SULTANS.                                         |
|--------------------------------|-----|-----------------------------------------------------------|
| 589                            | 1   | Muiz-ud-din Muhammad bin Sâm (1st Dynasty.)               |
| 602                            | 2   | Kutb-ud-din Aibek.                                        |
| 607                            | 3   | Arám Sháh.                                                |
| 607                            | 4   | Shams-ud-din Altamsh.                                     |
| 633                            | 5   | Rukn-ud-din Fírúz Sháh I.                                 |
| 634                            | 6   | Sultán Riziah.                                            |
| 637                            | 7   | Muiz-ud-din Bahrám Sháh.                                  |
| 639                            | 8   | Alá-ud-din Masaúd Sháh.                                   |
| 644                            | 9   | Násir-ud-din Mahmúd.                                      |
| 664                            | 10  | Ghiás-ud-din Balban.                                      |
| 685                            | 11  | Muiz-ud-din Kaikubád.                                     |
| 688                            | 12  | Jalál-ud-din Fírúz Sháh II., <i>Khilji</i> (2nd Dynasty). |
| 695                            | 13  | Rukn-ud-din Ibráhim.                                      |
| 695                            | 14  | Alá-ud-din Muhammad Sháh.                                 |
| 715                            | 15  | Shaháb-ud-din Umar.                                       |
| 716                            | 16  | Kutb-ud-din Mubáarak Sháh I.                              |
| 720                            | 17  | Násir-ud-din Khusrú.                                      |
| 720                            | 18  | Ghiás-ud-din Tughlak Sháh (3rd Dynasty).                  |
| 725                            | 19  | Muhammad bin Tughlak.                                     |
| 752                            | 20  | Fírúz Sháh III., <i>bin Salar Rajab</i> .                 |
| 790                            | 21  | Tughlak Sháh II.                                          |
| 791                            | 22  | Abúbakr Sháh.                                             |
| 793                            | 23  | Muhammad Sháh bin Fírúz Sháh.                             |
| 795                            | 24  | Sikandar Sháh.                                            |
| 795                            | 25  | Mahmúd Sháh bin Muhammad Sháh (Timúr, 800).               |
| 797                            | 26  | Nusrat Sháh, <i>Interregnum</i> , Mahmúd restored, 802.   |
| 815                            | 27  | Daulat Khán Lodí.                                         |
| 817                            | 28  | Khizr Khán <i>Syud</i> (4th Dynasty).                     |
| 824                            | 29  | Muiz-ud-din-Mubáarak Sháh II.                             |
| 839                            | 30  | Muhammad Sháh bin Faríd Sháh.                             |
| 849                            | 31  | 'Aálam Sháh.                                              |
| 854                            | 32  | Bahlól Lódí (5th Dynasty).                                |
| 894                            | 33  | Sikandar bin Bahlól.                                      |
| 923                            | 34  | Ibráhim bin Sikandar (Báber, 930 A.H.)                    |
| 937                            | 35  | Muhammad Humáyún, <i>Moghul</i> .                         |
| 946                            | 36  | Faríd-ud-din Shír Sháh, <i>Afghán</i> .                   |
| 952                            | 37  | Islám Sháh.                                               |
| 960                            | 38  | Muhammad 'Aádil Sháh.                                     |
| 961                            | 39  | Ibráhim Súr.                                              |
| 962                            | 40  | Sikandar Sháh (Humáyún, 962 A.H.)                         |

The unenlivened Chronicles of the Local Governors of Bengal enter upon a more interesting phase, in the nomination of Násir-ud-din

Mahmúd, the son, of the Emperor Balban, who subsequently came to prefer the easy dignity of Viceroy, in the more even climate of the south, in derogation of his birth-right's higher honours, and the attendant dangers of Imperialism at Dehli. One of the most touching chapters of Indian history is contributed by the incidents of this monarch's meeting with his own arrogant son, Muiz-ud-dín Kaikubád, who had succeeded to the superior dignities abjured by the father.\* They then met as nominal Vassal and Suzerain, but little unequal in power, and each occupying independent and preparedly hostile camps, on the ordinary route between their respective capitals. Oriental etiquette, and more reasonable distrust, for a time delayed the interview, in which, at last, nature was destined to re-assert its laws, and to reconcile even conflicting royal interests, by subduing, for the moment, the coarse vices of the son in the presence of the tempered virtues of the father. Repeated amicable conferences, however, merely resulted in each returning on his way, with but little change in the relative political position of either; and the comparatively obscure repose of Násir-ud-dín Mahmúd remained undisturbed, while other successors filled his son's throne at Dehli. The more immediate question bearing upon the attribution of the earliest coins in the Kooch Bahár treasure, is exactly how long did Násir-ud-dín continue to live and reign. Zíá-i-Barni,† and those who follow his ill-digested history, affirm that he retained his provincial kingship till 699 A.H., when he divested himself of all symbols of royalty in the mere dread of the confessedly overwhelming power of Alá-ud-dín Muhammad Sháh, to be, however, reinstated by that Sultán; and, finally, it is asserted that Násir-ud-dín was still in existence, and once again reinvested with the full insignia of a king, by Tughlak Sháh, in A.H. 724.

Ibn Batutah, a higher authority in proximity of time, and obviously more intimate with the purely indigenous history, states that Násir-ud-dín, on his return from his interview with his son, reigned some years (سنتين), ‡ an expression which is scarcely compatible with

\* Zíá-i-Barni, p. 142; Ibn Batutah, iii., p. 178; Lee's Translation, p. 117; and *قران السعدين* of Amír Khusrú, *Dehli*.

† Printed edition, p. 451; Budauni MS.; Ferishtah (Briggs, i. p. 406).

‡ French edition, iii., p. 179, and xiii. Dr. Lee's *سنتين* "two years," p. 118, is an error.

the idea of a nearly continuous rule of "forty-three solar years," and a decease in A.H. 725, as adopted by Stewart:\* a prolongation of administrative functions indeed altogether inconsistent with the direct evidence of the dates on the money of Kai Káuś, or the parallel proof of Shams-ud-dín's exercise of the functions of sovereignty in 702 A.H., associated as they are with the uncontested historical and numismatic demonstration of the succession of one grandson, Shaháb-ud-dín, whose ejection from his inherited section of the kingdom by his more powerful brother, Bahádur, formed so prominent a ground for imperial interference in the affairs of Bengal. These facts are each and all too well ascertained to leave any doubt that the authors who make Násir-ud-dín's reign extend to 725 must be in error; the source of the mistake seems as simple as it is obvious, the mere omission of the son's name as preceding that of the father, in Persian MS. writing, or simple ignorance of the order of local successions, would account for the whole difficulty. And, as is obvious, Ibn Batutah's own personal knowledge, and possibly correct autograph version, reproduced independently in other lands, have not saved later transcripts of his work from analogous imperfections.†

But there are other and more direct internal evidences in the texts of the Indian authors, of confusion and imperfect knowledge in the relation of the incidents attendant upon the re-settlement of Bengal by Alá-ud-dín A.H. 699,\* where it is stated that "a chief, named Bahádur Khán," was at this time appointed to "the eastern districts of Bengal,"‡ with the object of dividing the province, and thus rendering its rulers "more subservient to the Court of Dehli." It is highly improbable, had Násir-ud-dín been living at the epoch in question, that a grandson of his should have been selected for such a charge to the succession of his own father, Shams-ud-dín, or in priority to the son of that father, Shaháb-ud-dín, who was the elder or perhaps better-born brother of Bahádur, each of whom, Ibn Batutah

\* Stewart's Bengal, p. 80.

† Ex. gr., Bahádur is made the son of Násir-ud-dín, at p. 179, vol. iii., instead of the grandson, which the text at p. 210, vol. iii., and p. 213, vol. iv., affirms him to have been. Lee's MS. authorities again, in omitting the intermediate name of Násir-ud-dín, skip a generation, and ante-date Shams-ud-dín (Firúz) in constituting him a son of Ghías-ud-dín Balban (p. 128).

‡ Ferishtah, Briggs, i., p. 406; Stewart, p. 79.

certifies, in turn succeeded to royal honours in the old capital of Bengal.

Having completed this simple outline of the historical data, I now proceed to describe the coins in their due order; first on the list in priority of time is a piece which I can only doubtfully assign to Bengal, and whose individual appropriation, moreover, must remain to a certain extent inconclusive. The coin itself will be seen to bear the hereditary name of the first Moslem Conqueror of India, *Mahmūd* of Ghaznī, and the oft-revived title of the founder of the dynasty, *Násir-ud-dín* Subuktagin, a conjunction of royal designation already seen to have been applied to a succession of Pathán princes, whose intitulation followed antecedent conventionalisms.

*Násir-ud-dín. Mahmūd Sháh.*

No. 1.

Silver. Size, viii. Weight, 163.1 grs. Unique, *British Museum.*

OBV.

REV.

السلطان الاعظم

في عهد الامام

ناصر الدنيا والدين

المستنصر بالله امير

ابو المظفر محمود

المومنين لله

شاه بن سلطان

Margin, illegible.



The incidental details of the legends restrict the assignment of this piece to one of *two* individuals, the eldest or the youngest son of Altamsh, the latter of whom was authoritatively designated by the like name and title on the decease of his brother, in 626 A.H.\* The

\* سلطان اسلام ناصر الدين محمود چنانچه وارث اسم ولقب او است  
Tabakát Násir, p. 181 ; گردانیده p. 201. پسر مهتر مخصوص

citation of the formula, "during the reign of (the Khalif) Al Mostansir billah," on the reverse, limits the final period of the issue of the coin, not exactly to the 5th month of the year A.H. 640, when that Pontiff died, but with clear precision to A.H. 641, when the knowledge of his death was officially declared by the substitution of a new name in the Mintages of the capital of Hindustán.\*

This younger son was destined eventually to succeed to the throne of his father at Dehli, in 644 A.H., after the intervening reigns of Rukn-ud-dín Fírúz Sháh, Rizíah, Muiz-ud-dín Bahrám Sháh, and Alá-ud-dín Masaúd Sháh, in all, however, extending only over a space of eleven years, posterior to the death of Altamsh. The second Mahmúd, must, under these conditions, have been but of tender years, and though, at this conjuncture, promoted to the titular honours of an elder brother, not in any position to exercise authority in his own person, and less likely to have had medallie tribute paid to him by his father, should such have been the origin of the exceptional specimen under review. To the first-born Násir-ud-dín Mahmúd, no such objections apply; he was very early invested by his sire with the administration of the important government of Hānsi, and in 623 A.H., advanced to the higher charge of the dependencies of Oudh, from which *quasi* frontier, he was called upon to proceed against Hisám-ud-dín Avaz, (No. 4 in the list of Governors, *supra*), who had already achieved a very complete independence in the province of Bengal. Here, his arms were fortuitously, but not the less effectually, successful, so that he had honours thrust upon him even to the Red Umbrella, and its attendant dignities,† whatever the exact measure of these may have been. Under such triumphant coincidences, it is possible that the universal favourite, the still loyal heir-apparent, may have placed his own name on the coinage, without designed offence, especially as at this time Moslem Mints were only beginning to adapt themselves to their early naturalization on Indian soil, and when the conqueror's camps carried with them the simple machinery, and equally ready adepts, for converting bullion plunder on the instant into the official money of a general, or his liege sovereign. Altamsh's

\* Pathán Sultáns of Dehli, coin No. 33, p. 22.

† His title is usually limited by Minháj-ul-Siráj to ملك pp. 177, 181, 201; but on one occasion سلطان crops out incidentally in the Court list where, in his place among the sons of the Emperor Altamsh, he is so designated, p. 178.

own circulating media were only in process of crude development at this period, and had scarcely risen superior to the purely Hindu currencies it had served the purpose of his predecessors to leave virtually intact :• his own strange *Túrki* name,\* and that of many of his successors, continued to figure in the *Nágarí* letters of the subject races on the surfaces of the mixed silver and copper coins of indigenous origin, at times commemorative of imperfectly achieved conquests, and the limited ascendancy implied in the retention of the joint names of the conqueror and the momentarily subject monarch ;† while the Sultán's own trial-pieces, in silver, were indeterminate in their design and legends, as well as utterly barbarous in their graphic execution.

Had the coin under review followed the usual phraseology and palæography of the Imperial Násir-ud-dín Mahmúd's Mint legends, it might have been imagined that an ancient and obsolete reverse had been, by hazard, associated with a new obverse. But the obverse inscription in the present instance differs from the latter Dehli nomenclature in the addition of the word *Sháh* after the name of *Mahmúd*,‡ and contrasts as singularly in the forms of the letters, and the

\* This name I have, as a general rule, retained in the form accepted as the conventional English orthography—*Altamsh*. The correct rendering of the original is still an open question, but the more trustworthy authors reproduce the designation as *التمش*, a transcription supported in a measure by the repetition of the third letter in the Kufic dies, and made authoritative, in as far as local pronunciation is concerned, by the Hindí correlative version of *लतिनिर्मिषि* (Pathán Sultáns, Coin No. 14). The inscription on the KUTB MINÁR, at Dehli, has *يَلْتَمِش*, which accords with the Arabic numismatic rendering on the reverses of the Hindí Coins now cited.

See also *Táj-ul-Maásir*, *Alitimish*: *Wasáf*, *Alitimish*, and at times *التمش* Badauni, *Ailtitimish*.

Elliot's *Historians of India*, p. 111.

† See coins of *Chahír deva*.

*Obverse*. Bull. Legend: *बसावरी श्री समसेरलदिवि ।*

*Reverse*. Horseman. Legend: *श्री चाहड देव ।*

— Pathán Sultáns, No. 15 ; *Ariana Antiqua*, pl. xix. 16. 31, 34 ; Prinsep's *Essays*, i. 333, pl. xxvi. 31 ; *Minhaj-ul-Siráj*, pp. 215, 240 ; *Tod's Rajasthan*, ii. 451 ; and *J. A. S. Bengal*, 1865, p. 126.

‡ So, in written history, Násir-ud-dín Mahmúd, the Emperor, is called by his own special biographer, *سلطان المعظم ناصر الدنيا والدين محمود بن السلطان*

(pp. 9, 177, 178, 201, etc.) which is in contrast to the nominal adjunct so constant with his predecessors, *Firúz Sháh*, *Bahrám Sháh*, *Masáúd Sháh*. On one occasion only does the additional *Sháh* appear in a substituted list of *Altamsh's* Court (p. 178), where the text gives—1. Sultán Násir-ud-dín \* \* 2. Sultán Násir-ud-dín Mahmúd ; and at the end, after the name of *Rukn-ud-dín Firúz Sháh*, comes "Násir-ud-dín Mahmúd *Sháh*."

insertion of the short vowels with the more deferred issues, as it, on the other hand, closely identifies itself in these marked peculiarities with the initial dies of Altamsh and the closely sequent coinages of Riziah, two of which latter are now known to be the produce\* of the Lakhnauti Mint.

### RIZIAH. \*

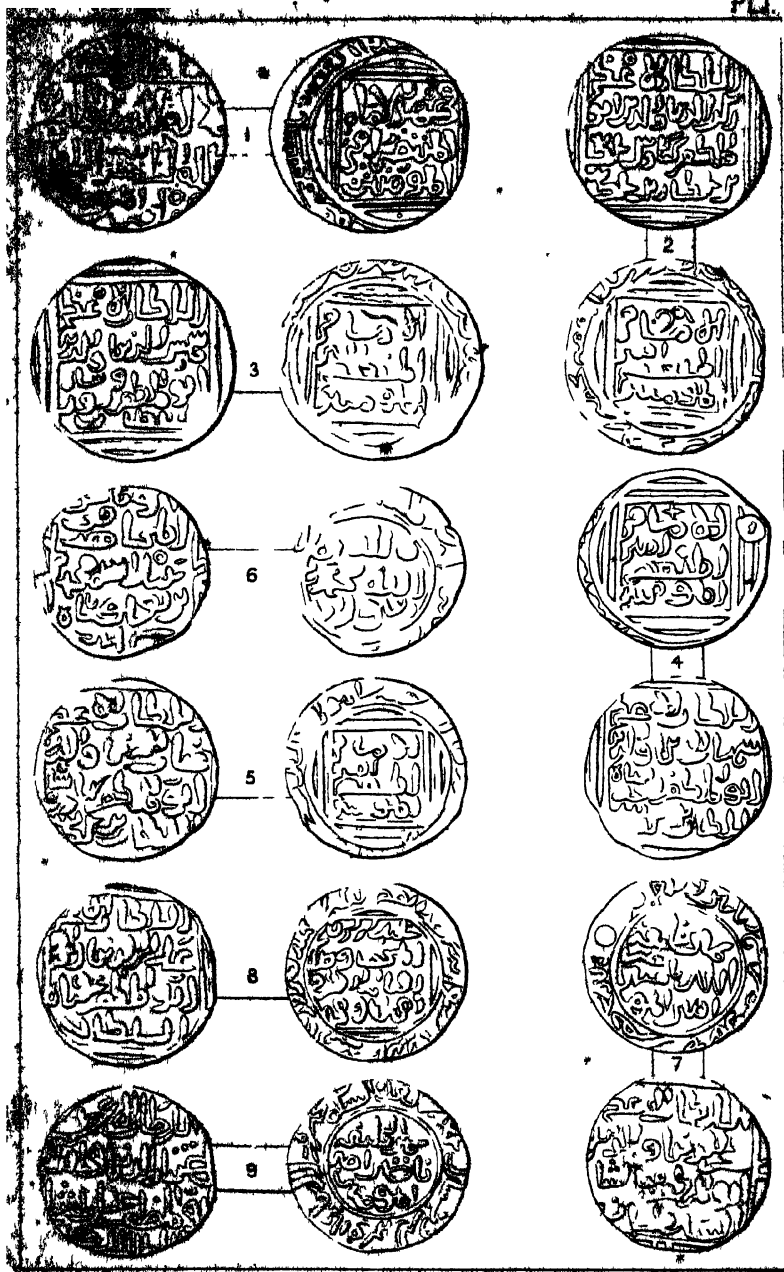
The earliest coins that can be definitely attributed to a Bengal mint, are those of the celebrated Queen Regnant of Muhammadan India—Riziah, the daughter of Altamsh. The ministers at her father's court were scandalized at the preference it was proposed to extend to a daughter, in supercession of the claims of adult male heirs to the throne; but the Sultán justified his selection, alike on account of the demerits of his sons, and the gifts and acquirements of his daughter, who had been brought up under the unusual advantages of freedom from the seclusion enjoined for females by the more severe custom of ordinary Moslem households, aided by the advantages incident to the exalted position occupied by her mother as the leading and independently-domiciled wife. After the brief reign of Rukn-ud-dín Firúz, extending over less than seven months—who freely exemplified by his misconduct his father's prophetic reproach—Riziah succeeded in establishing her supremacy in the city of Dehli (A. H. 734), and Eastern eyes witnessed the singular spectacle of an unveiled and diademed Queen—the first in India—directing the hosts of Islám, under the canopy of the immemorial regal seat on an elephant. Riziah's early inauguration was attended with no inconsiderable danger and difficulty, arising from the organised military resources of the various governors of provinces, who hesitated in conceding their allegiance. Eventually, however, to use the expression of Minháj-ul-Siráj, quiet was established throughout the empire, and Riziah's sway was acknowledged from "Daibal to Lakhnauti." In A. H. 737, the Empress proceeded in person to quell an outbreak on the part of Ikhtíár-ud-dín Altúniah, Governor of Tiberhind; but was taken captive in the engagement that ensued, and, possibly with scant ceremony, introduced into the harem of the conqueror, who shortly afterwards advanced upon Dehli in the hope of recovering the sovereignty, to which he had thus acquired an adventitious claim; but





# BENGAL COINS.

PL.



his army was in turn defeated, and himself and Riziah met their deaths near Kaithal in the month of Rabi-al-Awal, A.H. 738. \*

The contemporary biographer in his official lists styles this queen *السلطان رضية الدين*, a title which she affects on the ordinary copper coins,† but on the silver money she adopts the designation of *جلالة الدين*

*Jalalat-ud-din. Riziah.*

COIN No. 2.

Laknauti, A.H. ?

Silver. . Size, vii. Weight, 168 grs. Plate I., figure 1.

Type, *Obverse*, the whole surface is occupied by the legend.

- *Reverse*, circular area, enclosing a double-lined square. Narrow margin.

| OBV.                    | REV.          |
|-------------------------|---------------|
| السلطان الاعظم          | في عهد الامام |
| جلالة الدنيا والدين     | المستنصر امير |
| ملكة ابنت التمش السلطان | المومنين      |
| صهرة امير المومنين      |               |

*Reverse Margin*, \* \* هذا الفضة بكنوتي سنة

(See also a similar coin from the Laknauti Mint, Plate i., fig. 27, page 19. Coins of the Pathán Sultáns of Hindústán.‡

\* Tabakát Násiri, pp. 183, 185, 251. See also Ibn Batutah, iii. pp. 167, 168.

† Pathán Sultáns, Nos. 28, 29.

‡ It would seem from the orthography adopted in this earliest record of the name of *Laknauti* (لكنوتي) that the original Semitic transcription was designed to follow the classical derivation of *Lakshmanavati* (लक्ष्मणवती), which was soon, however, adapted to the more colloquial *Luchhman* (لچھمن) by the addition of an *h* after the *k*, *كهنوئي*; in which form it appears under the first local Sultáns (coin No. 3, etc.). Minháj-ul-Siráj relates its elevation to the rank of the capital in supercession of Nuddeah by Muhammad Bakhtiár in the following terms: چون محمد بخنيار آن مملكت را ضابط كرد شهر نو ديده را خراب بگذاشت و بر موضعي كه لکهنوتی است دارالملک ساخت

Printed edit. p. 151. The same author, at p. 162, gives a full account of the remarkable size, progress, and general topography of the city as existing in 641 A.H. on the occasion of his own visit.

It is difficult to say when the name of the city was changed to *Gaur*, a denomination which is never made use of by the older authorities. Abul Fazi says,

## I.—RUKN-UD-DĪN KAI KĀU'S.

The full and satisfactory identification of the king who ruled under the designation of Kāús has yet to be accomplished. Rājendralála Mitra has suggested a notion that Násir-ud-dín Mahmúd, the son of Balban, so often mentioned in this article, sought, as local ruler of Bengal, "to continue his allegiance to his grandson Kaimurs [momentarily king of Dehli], even after his deposition, and possibly after his death,"\* by retaining his name on the public money. I should be disposed to seek a less complicated explanation of the numismatic evidences. Kai Kāús' date, tested by the examples of his mintages in the Kooch Bahár hoard, is limited, in range of time, to five years (691–695 A.H.);† a latitude might be taken beyond the ascertained units, which are somewhat indeterminate in their tracings, and have equally suffered from abrasion, on the exposed margins of the coins, but the *ninety* and the *six hundred* can scarcely be contested. If we examine the political state of India at this period, we find that Hindustán was abnormally quiet under the feeble rule of Jalál-ud-dín Fírúz (687–696 A.H.): Alá-ud-dín's conquests in the Dakhin could have but little affected Bengal, so that any changes that may have taken place in the latter kingdom were probably due to successional or revolutionary causes arising within its own limits. We can scarcely build up a theory of an access of vigour and assumption of

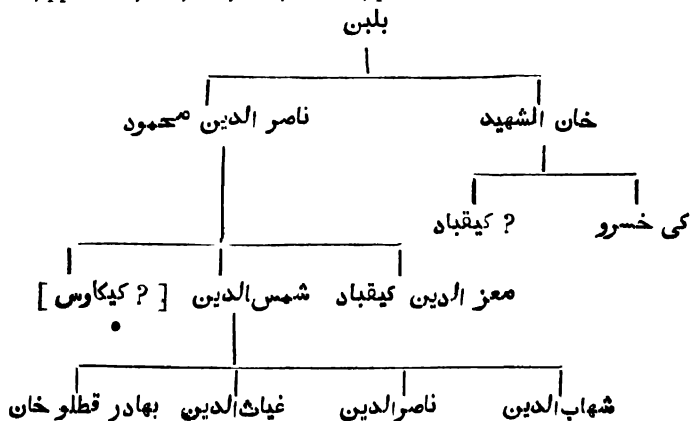
"Formerly it was called Lucknouty, and sometimes Gour" (A.A. ii p. 11); while Budáúni gives a ridiculous version of the origin of the designation as being derived from غوري. He writes *و محمد بخنيار معابد و بنجا نهاي* كفاررا ويران ساخته مساجد و خوانق و مدارس كرد و دارالملك بنام خویش تعبیر فرمود كه كور نام دارد. The obvious imperfection of the critical philology of the derivation, however, debars its reception, as does the caustic alternative of گور—"grave," which the often deserted site, under the speedy action of water and a semi-tropical vegetation, may have deservedly earned for it. But it is quite legitimate to infer that as গৌড় was the ancient name for central Bengal (Wilson, Glossary, *sub voce*; Albíruní, quoted J. R. A. S. i., N. S., p. 471), and so intimately associated with the tribal divisions of the indigenous Brahmans, that the designation originated in the popular application of the name of the country to its own metropolis, and that the town continued to be called *Gaur* in vernacular speech in spite of the new names so frequently bestowed upon it by its alien lords.

\* Jour. As. Soc. Beng., 1864, p. 508.

† Rājendra Lála says, "the units *one* and *three* are perfectly clear." Col. Guthrie's three coins are imperfect in the word for the unit. I observe traces of a *four* on two specimens; and I read, with some certainty, 695 on another.

independence by Násir-ud-dín himself; nor is it probable that, in such a case, he would have changed both his title and his name. Besides, the array of title on the coins in the triple succession of *Sultáns* is altogether inconsistent with his actual origin. Though he was the son of one emperor of Dehli, and the father of another, he could scarcely ignore the rise of the former from a state of slavery, or conceal the fact that Balban himself never pretended to have been the offspring of a king. The two alternatives remain, of either supposing that Násir-ud-dín died before 691 A.H., a question discussed elsewhere, or to conclude that his son Rukn-ud-dín Kai Káús temporarily assumed kingship during the lifetime of his father,\* and that his limited reign and local obscurity saved his memory from the comments of history. I fully endorse Rajendra Lál's suggestion that Kai Káús would have been likely to be selected as a name for one of a family who took so many of their designations from Persian heroic ages, and the elaborate intitulation adopted by that prince, on his coins, of the "son and grandson of a Sultán," favours such an identification.† It will be seen that, although the opening terms of his obverse legends follow the conventional and unvarying mint phraseo-

\* The following is the genealogical tree, according to Ibn Batutah. See vol. iii., pp. 174-5, 179, 210, 462; vol. iv., p. 212.



† The name of the son of Kai Kobád, who was elevated to the throne of Dehli on the death of his father, is variously given by Oriental writers as Shams-ud-dín. کيکاوس and کيکومرش. Budáuní and the *Mirát-ul-Alm* (MS.) give *Kai Kaus*, but the majority of authors prefer the *Kaiomurs*. Zíá-i-Barni does not state the name of the boy, but mentions a son of Altamsh, in the previous generation, as having been called *Kaiomurs* (printed ed. p. 126).

logy in the use of السلطان, *the* (reigning) Sultán, yet after his own proper name he styles himself merely سلطان, and seemingly desired to strengthen his position by the insertion of the regal titles of his father and grandfather; though there is so far room for questioning this supposition in the fact that the father had fallen short of supreme power, and was only doubtfully authorized to call himself Sultán, while in strictness the Imperial *Balban* should have been designated *the Sultán* (past regnant); but on the other hand, Násir-ud-dín had been so long virtually a king in the south, that the complimentary use of the term was quite within heraldic licence; and it is to be remarked, that a similar omission of the supreme prefix occurs in *Nasir-ud-dín Mahmúd Sháh's* coin (No. 1), which, if correctly attributed, would prove the legitimacy\* of the optional use of one or the other form.

These are avowedly mere speculations; but when it is considered how much attention was paid in India, in those days, to every varying shade and degree of honorary rank, how much importance was attached to even the colours of official umbrellas,† and other, to us, minor observances, it cannot but be felt that these subordinate indications may chance to prove of material aid in illustrating doubtful interpretations.

Kai Káús.

No. 3.

Lakhnautí, A.H. "691, 693,"‡ and 694-695.

Silver. Size, vii. Weight, 168 grs. Very rare. Plate I. fig. 2. Type, as in the previous coins.

\* The Bengal Mints, after the initial uncertainty, soon settle themselves down to follow the established Dehli models. In the latter, it will be seen, great care was taken by all those sovereigns who could boast of a Royal descent, to define the fact upon their coins. Bahrám Sháh, Masáúd Sháh, Násir-ud-dín Mahmúd bin Altamsh, and Ibrahim bin Firúz all entitle themselves بنه السلطان. Balban, Kai Kubád, Jalál-ud-dín Firúz, and the great Alá-ud-dín Muhammad Sháh have to be content with their own self-achieved السلطان

† Minháj-ul-Siráj, p. 263; *چتر برداشت لعل و سیاه و سپید* ditto, p. 181, A.H. 625.

‡ Bábu Rájendralála Mitra notices four coins of this king with the dates 691 and 693. Journ. As Soc. Bengal, 1864, p. 579. He was disposed to read the mint as Sunárgaon. Of Col. Guthrie's three specimens, two bear distinct traces of the name of Lakhnautí.

| Obv.                                                       | Rev.         |
|------------------------------------------------------------|--------------|
| السلطان الاعظم                                             | الامم        |
| ركن الدنيا والديني ابو                                     | المستعصم     |
| المظفر كيكاس سلطان                                         | اميرالمومنين |
| بن سلطان بن سلطان                                          |              |
| Margin, ضرب هذا الفضة بحضرت لكهنوتي سنة خمس وتسعين وستمائة |              |

## II.—SHAMS-UD-DI'N FIRUZ.

Whatever may have been the actual date of Násir-ud-dín's decease or political obscuration, we tread upon more firm ground in the conjoint testimony of the coins and the historical reminiscences of Ibn Batutah, in the assurance that his son, Shams-ud-din Fírúz, was in full possession of power in Western Bengal at the time of Muhammad bin Tughlak's abortive revolt against his own father, in 722-3 A.H.\* The African traveller incidentally mentions that to the court of this southern monarch fled the nobles who had engaged in the contemplated treason, which originated in the camp of the army of the Dakhin, of which the imperial heir was commander. Professedly written history is altogether at fault in establishing the existence or illustrating the reign of this sovereign; and even Ibn Batutah†

\* As this passage presents no particular difficulty, beyond the difference of the texts from which English and French translators have drawn their inspiration, I merely annex the rendering given in the amended Paris edition, vol. iii., p. 210. "Les autres émirs s'enfuirent près du Sultan Chems eddîn, fils du sultan Nâcir-eddîn, fils du sultan Ghiyâth eddîn Balaban, et se fixèrent à sa cour. . . Les émirs fugitifs séjournèrent près du sultan Chems eddîn. Dans la suite, celui-ci mourut, léguant le trône à son fils Chihâb eddîn. Ce prince succéda à son père; mais son frère cadet, Ghiyâth eddîn Behâdoûr Bôurah (ce dernier mot signifie, dans la langue indienne *le noir*), le vanquit, s'empara du royaume, et tua son frère Kothloû Khân, ainsi que la plupart de ses autres frères. Deux de ceux-ci, le sultan Chihâb eddîn, et Nâsir eddîn, s'enfuirent près de Toghlok, qui se mit en marche avec eux, afin de combattre le fratricide. Il laissa dans son royaume son fils Mohammed en qualité de vice-roi, et s'avança en hâte vers le pays de Lacnadouty. Il s'en rendit maître, fit prisonnier son sultan Ghiyâth eddîn Behâdoûr et reprit avec ce captif le chemin de sa capitale." See also Lee's Translation, p. 128.

† Ibn Batutah in the following extract tells us so much about the real history of Bengal at, and previous to his own visit, that I quote the Arabic text *in extenso*; I feel it is the more necessary to reproduce the original version on this occasion, as Dr. Lee's translation is altogether deficient in any reference to the passage, which was clearly wanting in the MSS. at his disposal.

\* . . . ذكر سلطان بنجاله وهو السلطان ناصر الدين الملقب بفخره  
سلطان فاضل محب في الغرباء وخصوماً الفقراء والمتصوفة وكانت

does little more than place upon record the affiliation, elevation, and decease of Shams-ud-dîn, whose own coins alone furnish the additional item of his regal name of Fîrûz; and in their marginal records

مملكة هذه البلاد للسلطان ناصر الدين بن السلطان غياث الدين بلبن وهو الذي ولي ولده معز الدين الملك بدلهي فتوجه لقتاله والنقيا بالنهر وسمي لقاوهم لقاء السعدين وقد ذكرنا ذلك وانه ترك الملك لولده وعاد الى بنجالة فاقام بها الى ان توفي وولى ابنه شمش الدين الى ان توفي فولى ابنه شهاب الدين الى ان غلب عليه اخوه غياث الدين بهادور بور فاستنصر شهاب الدين بالسلطان غياث الدين تغلق فنصره واخذ بهادور بور اسيرا ثم اطلقه ابنه محمد لما ملك على ان يقاسمه ملك فنكت عليه فقاتله حتى قتله وولى على هذه البلاد صهرا له فقتله العسكر واستولى على ملكها على شاه وهو اذ ذاك ببلاد الككنوتى فلما راي فخر الدين ان الملك قد خرج عن اولاد السلطان ناصر الدين وهو مولى لهم خالف بسدكاوان وبلاد بنجالة واستقل بالملك واشتدت الفتنه بينه وبين على شاه فاذا كانت ايام الشتاء والوحل اغار فخر الدين على بلاد الككنوتى فى البحر لقوته فيه واذا عادت الايام التى لامطر فيها اغار على شاه على بنجالة فى البحر لقوته فيه

Vol. iv. p. 212, Paris edition.

#### TRANSLATION.

C'est le Sultan Fakhr eddîn, surnommé Fakreh, qui est un souverain distingué, aimant les étrangers, surtout les fakîrs et les soufis. La royauté de ce pays a appartenu au Sultan Nâssir eddîn, fils du Sultan Ghiyâth ed dîn Balban, et dont le fils, Mo'izz eddîn, fut investi de la souveraineté à Dihly. Nâssir eddîn se mit en marche pour combattre ce fils; ils se rencontrèrent sur les bords du fleuve, et leur entrevue fut appelée la rencontre de deux astres heureux. Nous avons déjà raconté cela, et comment Nâssir eddîn abandonna l'empire à son fils et retourna dans le Bengale. Il y séjourna jusqu'à sa mort, et eut pour successeur son (autre) fils, Chams eddîn, qui, après son trépas, fut lui-même remplacé par son fils, Chihâb eddîn, lequel fut vaincu par son frère, Ghiyâth eddîn Bêhâdour Boûr. Chihâb eddîn demanda du secours au Sultan Ghiyâth eddîn Toghlok, qui lui en accorda, et fit prisonnier Bêhâdour Boûr. Celui-ci fut ensuite relâché par le fils de Toghlok, Mohammed, après son avènement, à condition de partager avec lui la royauté du Bengale; mais il se révolta contre lui, et Mohammad lui fit la guerre jusqu'à ce qu'il le tuât. Il nomma alors gouverneur de ce pays un de ses beaux-frères, que les troupes massacrèrent. 'Aly Châh, qui se trouvait alors dans le pays de Lacnaouty, s'empara de la royauté du Bengale. Quand Fakhr eddîn vit que la puissance royale était sortie de la famille du Sultan Nâssir eddîn, dont il était un des affranchis (ou clients), il se révolta à Sodcawân et dans le Bengale, et se déclara indépendant. Une violente inimitié survint entre lui et 'Aly Châh. Lorsqu'arrivaient le temps de l'hiver et la saison des pluies, Fakhr eddîn faisait une incursion sur le pays de Lacnaouty, au moyen du fleuve, sur lequel il était puissant. Mais quand revenaient les jours où il ne tombe pas de pluie, 'Aly Châh fondait sur le Bengale par la voie de terre, à cause de la puissance qu'il avait sur celle-ci.



establish the fact of his possession of Lukhnautí during the period embraced between the years 702-722, and (at some moment) of his ownership the Eastern Province of Bengal represented by the mint of Sonárgaon. A subordinate incident is developed in the legends of the coins, that he felt himself sufficiently firm in his own power to discard the supererogatory adjuncts of descent or relationship, and relied upon the simple affirmation of his own position as السلطان.

*Shams-ud-din. Fírúz Sháh.*

No. 4.

Lakhnautí, A.H. 702,\* 715, (Col. Bush), 720, 722.

Silver. Size, vii. Weight, 168.4 grs. Very rare. Plate I., fig. 3.

Type as above.

| Obv.                                               | Rev.          |
|----------------------------------------------------|---------------|
| السلطان الاعظم                                     | الامام        |
| شمس الدنيا والدين                                  | المستعصم      |
| ابو المظفر فيروز شاه                               | امير المؤمنين |
| السلطان                                            |               |
| Margin, [ سبعمائة ] و عشرين سنة لکھنؤی حضرت لکھنؤی |               |

No. 5.

Sonárgaon, A.H. ?

Silver. Size, vii. Weight, 168 grs. Unique.

Type as above.

III.—SHAHAB-UD-DIN. *BUGHRAH SHAH.*

Neither history, incidental biography, nor numismatic remains avail to do more than prove the elevation, as they seem to indicate the brief and uneventful rule, of Shaháb-ud-dín, the son of Shams-ud-dín Fírúz, and grandson of the once recognised heir-apparent of Balban.

\* See also Pathán Sultáns of Hindústán, p. 37, coin dated 702 A.H. This coin was published by me in 1848. I then read the date as 702 A.H. I was not at the time unversed in the decipherment of Arabic numbers, and probably from the very difficulty of placing the piece itself, I may the more rely upon the accuracy of my original interpretation. I mention this fact, as I am at present unable to refer to the coin itself.

The singularly limited number of the coins of this prince, confined—if Calcutta selections be not at fault\*—to three examples amid the 13,500 accumulated specimens of the currencies of other kings of the land over which he temporarily held sway, sufficiently mark his status in the general list of the potentates of the century in which he lived. No date or place of mintage is preserved on his extant money, and the single additional item supplied by their aid is his personal or proper name, which appears on their surfaces as *بعده*; a crude outline which might suggest a doubt as to the conclusiveness of the transcription of *بغرة*, now confidently adopted as expressing an optional rendering of the grandfather's title of *بغراخان*,† a name which was even further distorted from the Túrki original by the conversion of the medial *ر* into the vernacular *cerebral* *ز* or *د*. For the rest, the pieces themselves, under the mechanical test, in their make, the forms of their letters, and the tenor of their legends, evidently follow closely upon Shams-ud-dín's mintages, and as clearly precede the money of the same locality, issued by Ghíás-ud-dín *Bahádur Sháh* who in 724 A. H. drove this, his own brother, Shaháb-ud-dín to take refuge with Ghíás-ud-dín Tughlak Sháh. *Bahádur's* career has yet to be told in connexion with his own coins; but to dispose of Shaháb-ud-dín,‡ as far as the exercise of his Mint prerogatives are concerned, he seems to have been lost to fame, from the

\* The name of this king does not appear in any of Rajendralál's lists.

† The ancient name of *طنگاج بغراخان* of Bokhára notoriety in 350 A. H. (Fræhn *Recensio Numorum Muhammadanorum*, pp. 139, 593, 578), was subjected to strange mutations on Indian soil. My authority for the substitution of the final *ج* in place of the vowel *ا* is derived from Ibn Batutah, who uniformly writes the word with an *ج* (iii. 231, 5, 293.) Ferishtah (*text*, p. 131) has *بقرا*, whence Stewart's *Bagora* (p. 74). Dow gave the name as *Kera*, and Briggs as *Kurra* (i. pp. 265, 270, etc.).

‡ Those who delight in interesting coincidences might see, in this name of Shaháb-ud-dín, a most tempting opportunity for associating him with a really important record by the Indigènes themselves, inscribed on a stone slab in the fort of Chunár, setting forth their victory over a "*Malik*" Shaháb-ud-dín, quoted as acting under Muhammad bin Tughlak, in Samvat 1390 (A. H. 734); but I confess I do not myself encourage the identification. Chunár is certainly not out of the range of access from Bengal; but other men of mark may have filled this command, and the name of the fortress itself is never heard of in reference to the affairs of the kingdom of Lakhnauti, in those early days, though the main road of communication between the two capitals of the north and the south took its course through Budáun or Kanauj and Jaunpore. The inscription is otherwise well worthy of further examination, in as far as it concerns the history of imperial influence upon proximate localities; and as such I transcribe

date when he was absorbed with an associate fugitive brother (Násir-ud-dín) under the ægis of the Emperor of Dehli.

*Shaháb-ud-dín. Bughrah Sháh.*

No. 6.

Mint, ?

Silver. Size, vii. Weight, 168.5 grs. Two coins only, *Col. Guthrie. Plate I., fig. 4.*

both the text and Dr. Mills' translation of the brief passages which may chance to illustrate the general subject.

Verse 5 :

सचावदीनादिदुष्टात्मयवनेन्द्रमहाम्नादा ।  
सैराजो मि[स्त्रिनेऽस्म]जाल्यो वैरिणापि कृपानिधिः ॥

"By MUHAMMAD, lord of the hostile YAVANAS SHAHÁB-UD-DÍN and the rest, though an enemy, was SAIRÁJA, the treasure of bonignity, employed as prime minister."

Verse 11 :

संवत् १२९० भाद्रपदि ५ गुरौ सैराजदेवेनगर-  
शागतमल्लिकसचावदीनराचतं ॥

"Samvat 1390, in the month of Bhadra, fifth day of the waning moon, on Thursday, was the kingdom set free from MALIK SHAHÁB-UD-DÍN, acting under the protecting favour of SAIRÁJA DEVA aforesaid."

—See Journal As. Soc. Bengal, vol. v., 1836, p. 341).

A subordinate but still more open inquiry also suggests itself in connexion with the mention of Shaháb-ud-dín in 734 A. H., as to whether, amid the strange confusion of names and titles, the "Kadr Khán," who is noticed by Ferishtah under the original designation of Malik Bídár Khilji, may not, perchance, have been the identical Shaháb-ud-dín *Bughrah*, reinstated as simple governor in Lakhnauti, as his brother Bahádúr was restored to power in Sonárgaon. I am aware that this is treacherous ground to venture upon; but such a supposition is not without other incidental support, especially in Ibn Batutah's passage (original, iii. 214, quoted at p. 48), where Kadr Khán is spoken of as if he had been in effect the last member of the family of Násir-ud-dín Mahmúd Bughrah.

The original passages in Ferishtah are as follows (i. p. 237) :—

و ملك بیدار خلجی را قدر خان خطاب کرده چون شاه ناصر الدین فوت شده بود اقطاع لکهنوتی باو داد (i. p. 244) درین وقت یکی از نوکران قدر خان که او را ملک مخرالدین گفتندی بعد از فوت بهرام خان در بنگاله بغی ورزید و قدر خان را کشته خزاین لکهنوتی متصرف شد

See also Briggs' Translation, i. pp. 412, 423.

The Táríkh Mubárák Sháhi has the name in manifest mistranscription as *Bandár*.

و ملك بندار خلجی قدر خان شد و اقطاع لکهنوتی یافت

A difficulty necessarily suggests itself in regard to the tribe of *Khilji*, but the use of the name in its non-ethnic sense might readily be explained by the old subordination of the Bengal family to the Khilji dynasty of Firúz, or the specially *Khilji* serial succession of the earlier governors of Bengal.

Type as usual.

| OBV.                          | REV.          |
|-------------------------------|---------------|
| السلطان الاعظم                | الامير        |
| غياث الدنيا والدين            | المستعصم      |
| ابوالمظفر بهادر شاه           | امير المومنين |
| السلطان ابن سلطان             |               |
| Margin, (remainder illegible) | ضرب هذا       |

#### IV.—BAHÁDUR SHÁH.

The single point in the biography of Bahádur Sháh, which remains at all obscure, is the date of his first attaining power. Ibn Batutah records with sufficient distinctness, that he conquered and set aside his regnant brother *Shaháb-ud-dín*, sometime prior to Ghíás-ud-dín Tughlak's reassertion of the ancient suzerainty of Dehli over the lightly-held allegiance of Bengal, and his eventual carrying away captive the offending Bahádur, who was, however, soon to be released, and restored with added honours,\* by Muhammad bin Tughlak, almost immediately on his own accession. Indian home-authors, who so rarely refer to the affairs of the Gangetic delta, give vague intimations of the first appointment of Bahádur to Eastern Bengal by 'Alá-ud-dín Muhammad in A. H. 799,† assigning to him an inconceivable interval of placid repose until A. H. 717, when he is stated to have broken out into the turbulent self-assertion for which he was afterwards so celebrated.

The two statements are certainly at variance, but Ibn Batutah's is the most readily reconcilable with probabilities, and the demands of the up to this time legible dates on the coins which Bahádur put into circulation in Bengal. I might have some doubt as to the conclusiveness of the reading of the date 710 on his money in the Kooch Bahár *trouvaille*, but I have none as to the clear expression of A. H. 711 and 712, though the singular break occurring between 712 (or 714) and 720 suggests a suspicion of an originally imperfect

\* چون سلطان بهادر سنار گامی را بملک اوده رخصت کرد آنچه زب  
نقد در خزنه بود بیکبار در انعام او داد Tabakát-i-Akbari.

See also Zíá-i-Barni, printed edit. p. 461.

† Stewart, p. 75. Ferishtah (Briggs) i. 408.

die-rendering of the عشر = 10 for عشرين = 20;\* which would bring the corrected range of Bahádúr's dates to 720-724; but even these figures leave something to be reconciled in reference to their associate place of mintage, for in 720-722, his father, Shams-ud dín Fírúz, was clearly in possession of the already commemorated "*Lakhnauti*;" but such an anomaly might be explained by the supposition that Bahádúr, in the earlier days, used the name of *Lakhnauti* as a geographical expression for a portion of the dominions ordinarily administered from that capital. Undoubtedly the first appearance of the contrasted designation of the Eastern capital "*Sonárgaon*" occurs on a coin of his father; but even this sign of discrimination of urban issues would not be altogether opposed to a continuance by Bahádúr of the loose usage of Camp Mints, of naming the metropolis as the general term for the division at large, or inconsistent with the subsidiary legitimate employment of the designation of the province on a coinage effected anywhere within its own boundaries,—either of which simple causes may have prevailed, and been utilized with a new motive, if any covert ulterior meaning might be designed, as implying that Bahádúr himself had special successional or other claims to the metropolitan districts.

Tughlak Sháh's intervention in the affairs of Bengal seems to have originated in an appeal on the part of the ejected Shaháb-ud-dín against the usurpation of his brother Bahádúr. The result of the Imperial expedition to the South was the defeat, capture, and transport to Dehli of Bahádúr Sháh; but among the first acts of the new Sultán, Muhammad bin Tughlak, was the release and re-installation of the offender, showing clearly that he was something more than an ordinary local governor, transferable at will, and that possibly the interests of the father and son, in their newly-established dynastic rank, and the confessed insubordination of the latter, were independently advocated by the opposing members of the royal line of Bengal, whose family tree could show so much more ancient a series of regal successions than their parvenu Suzerains, whose elevation dated scarce five years back. One of the most interesting illustrations

\* Among more critical Arabic scholars than the Bengal Mint Masters ever affected to be, this point would have been easily determined by the insertion or omission of the conjunction *vau*, which, as a rule, is required to couple the units and the twenties, but is not used with the units and tens.

- of the present series is contributed by coin No. 9, in the legends of which Bahádur acknowledges the supremacy of Muhammad bin Tughlak over Eastern Bengal during A.H. 628.\* The subjection seems, however, to have been of brief duration, as sometime in or after the year A.H. 730 Bahádur appears to have reverted to an independent coinage, in a new capital called after his own title *Ghiáspur* (coin No. 8), and in A.H. 733 Muhammad bin Tughlak is found issuing his own coin in Bengal, and Bahádur, defeated and put to death, contributed an example to insurgent governors in his own skin, which was stuffed and paraded through the provinces of the empire.

rv. Bahádur Sháh.

No. 7.

Lakhnautí, A. H. 710 ?, 711, 712, 7-3, 7-4, † *break*, 720, 721, 722.

Silver. Size, vii. to viii. Weight, ordinarily, 166 grs.; one example is as high as 167.5 grs. Rare.

| OBV.                 | REV.          |
|----------------------|---------------|
| السلطان الاعظم       | الامام        |
| غياث الدنيا ولدين    | المستعصم      |
| ابو المظفر بهادر شاه | امير المؤمنين |
| السلطان بن سلطان     |               |

Margin, ضرب هذالفضة بحضرت لكهنوتي سنة احد وسبعماية

\* Ibn Batutah gives the following additional particulars of Bahádur's reinstallation:—"Il [Muhammad bin Tughlak] lui fit de nombreux cadeaux en argent, chevaux, éléphants, et le renvoya dans son royaume. Il expédia avec lui le fils de son frère, Ibráhím Khán; il convint avec Behádour Bourah qu'ils posséderaient le dit royaume par égales moitiés; que leurs noms figureraient ensemble sur les monnaies; que la prière serait faite en leur nom commun, et que Ghiyáth eddín enverrait son fils Mohammed dit Berbath (برباط), comme otage près du souverain de l'Inde. Ghiyáth eddín partit, et observa toutes les promesses qu'il avait faites; seulement il n'envoya pas son fils, comme il avait été stipulé. Il prétendit que ce dernier s'y était refusé, et, dans son discours, il blessa les convenances. Le souverain de l'Inde fit marcher au secours du fils de son frère, Ibráhím Khán, des troupes dont le commandant était Doldjí altatiry (دلجي التري). Elles combattirent Ghiyáth eddín et le tuèrent; elles le dépouillèrent de sa peau, qu'on rembourra de paille, et qu'on promena ensuite dans les provinces."—Vol. iii. p. 816.

† The dates 7-3, 7-4, may perchance be obliterated records of 723 and 724. I have placed them among the lower figures, but I have no sanction for retaining them in that position.

## No. 8.

Second Mint, Ghíaspúr. Date, 730.

Silver. Size, vii. Weight, 166 and 164.5 grs. Very rare. Two coins. *Col. Guthrie*. Plate I., fig. 5.

Margin, \* هذالسكة قصبه غياثپور سنه ثلاثين \*

iv. Bahádur Sháh,

as Vassal under Muhammad bin Tughlak.

## No. 9.

Sonárgaon, A.H. 728.

Silver. Weight, 140 grs. Unique. *Dehli Archaeological Society*.

*Obverse*, السلطان المعظم غياث الدنيا والدين ابو المظفر بهادر شاه  
السلطان ابن السلطان

*Reverse*, Area, ضرب بامر الواثق بالله محمد بن تغلق شاه

Margin, هذه السكة بحضرة ضاركانو سنه ثمان وعشرين وسبعماية

Muhammad bin Tughlak Sháh, Emperor of Hindustán,

(in his own name) after the re-conquest of Bengal.

## No. 10.

Lakhnauti, A.H. 733.

Silver. Small coins. Size, v. to  $v\frac{1}{2}$ . Weight of well-preserved coins, 168.5 grs. Five specimens, *Col. Guthrie*. Plate I., fig. 6.

OBV.

REV.

ابوبكر

المجاهدين

سبيلى الله

محمد بن تغلق شاه

٧٣٣

لا اله الا الله

محمد

رسول الله

*Reverse*, Margin,

ضرب هذه الفضة بشهر لکھنوتى سنه ثلاث و ثائين و سبعماية

If the place of mintage of these imperial coins had been illegible, I should almost have been prepared, on the strength of the peculiarity of the forms of the letters, to have assigned their execution to a Bengal artist. The original model for the type of coinage may be seen in fig. 90, page 54, Pathán Sultáns. The late Mr. G. Free-ling, of the Bengal C.S., has left on record his acquisition of a gold piece of the same design (from the Dehli Mint) dated A.H. 725.

## V.—FAKHR-UD-DIN. MUBÁRAK SHÁH.

On the departure of Muhammad bin Tughlak from Bengal, Tátár Khán, honorarily entitled Bahrám Khán, an adopted son of Ghíás-ud-dín Tughlak, seems to have been left in charge of the provinces included in the government of Sonárgaon, while the Lakhnauti division of the kingdom of Bengal was entrusted to Kadr Khán. On the death of Bahrám Khán,\* which is stated to have taken place in 739—but may probably have to be antedated to 737—Fakhr-ud-dín Mubárah, his *Siláhdár*, took possession of the government, and proclaimed his independence. He was in the first instance defeated by the troops sent against him from Lakhnauti, but finally succeeded in maintaining his authority, and, as the coins prove, in retaining his hold on Sonárgaon and its dependencies throughout the nine years, from 741 to 750 A.H., comparatively undisturbed. The history of the period is confused, and the dates given by the native authors prove of little value;† but the coins establish the fact that in 751 another ruler, designated *Ikhtiár-úd-dín* Gházi Sháh, presided over the Mints of Eastern Bengal.

v. *Fakhr-ud-dín*. Mubárah Sháh.

No. 11.

Sonárgaon, A.H. 737,—741, 742, 743, 744, 745, 746, 747, 748, 749, 750.

Silver. Size, vi. to vi½. Weight, 166.0 grs. Unique.

Plate I, fig. 7.

| OBV.                 | • REV.          |
|----------------------|-----------------|
| السلطان الاعظم       | يعين خليفه الله |
| فخر الدنيا والدين    | نام — راعيد —   |
| ابو المظفر مبارك شاه | المومني —       |
| السلطان — — —        |                 |

Margin,

ضرب هذه السكة بحضرة جلال منار كانو ستة سبع وثلثين وسبعماية

\* Nizám-ud-dín Ahmad says, Mubárah killed Bahrám Khán; while Abul Fazl affirms that Mubárah put Kadr Khán to death.—*Ayín-i-Akbari*, ii. 21.

† Ferishtah, Briggs, i. pp. 412-413; iv. 328. Stewart, pp. 80-83.



The above specimen is unique in date, and varies in the opening legend of the reverse from the less rare coins of later years, which commence with *يَمِينُ الْخَلِيفَةِ*\*

# VI.—'ALÁ-UD-DÍN. 'ALÍ SHÁH.

'Alí Sháh, whom Muhammadan writers, by a strange jumble, have endowed with the surname of his adversary Mubárah, and ordinarily refer to as "'Alí Mubárah,"† assumed kingship on the death of Kádr Khán, Muhammad Tughlak's representative at Lakhnauti, entitling himself 'Alá-ud-dín. The more important incidents of his reign are confined to his hostilities with his rival, Fakhr-ud-dín Mubárah of Sonárgaon, who possessed advantages in his maritime resources, while the rivers remained navigable for large vessels during the rainy season, but which were more than counterbalanced by Alí Sháh's power on land, which availed him for the greater part of the year, and which finally enabled him to establish his undisputed rule in the Western provinces.

His coins exhibit dates ranging from 742 to 746 A.H., and bear the impress of the new mint of the metropolis, Fírúzábád, an evidence of a change in the royal residence, which clearly implies something more than a mere removal to a new site proximate to the old Lakhnauti, whose name is henceforth lost sight of, and may be taken to indicate a strategic transfer of the court to the safer and less exposed locality of the future capital, Pandua.‡ 'Alí Sháh is stated to have been assassinated by his foster brother, Hájí Ilías.§

● *'Alá-ud-dín. 'Alí Sháh.*

No. 12.

Fírúzábád, 742, 744, 745, 746.

Silver. Size, vi½. Weight, 166.7 grs. Rare. Plate I. fig. 8.

Type as usual.

\* See also an engraving of his coin (dated 750) Pathán Sultáns, fig. 151 and page 82.

† Budauni MS. Ferishtah, iv. 329. Stewart, p. 82. Ayín-i-Akbari, ii. 21.

‡ Stewart, speaking of Fírúz's advance against Ilías, says, "the Emperor advanced to a place now called Feroseporeábád, where he pitched his camp and commenced the operations of the siege of Pandua," p. 84. There is a *Mahal* Fírúzpúr in *Sircar* Tandah, noticed in the Ayín-i-Akbari, ii. p. 2. See also the note from Shams-i-Siráj, quoted below (p. 61), under the notice of Ilías Sháh's reign.

§ Stewart, p. 83.

| OBV.               | REV.               |
|--------------------|--------------------|
| السلطان الاعظم     | سكندر الزمان       |
| علاء الدنيا والدين | المختص             |
| ابو انمظفر عيشاه   | بعنايت الرحمن ناصر |
| السلطان            | امير المؤمنين      |

Margin,

ضرب هذه الفضة السكه في البادة فيروز اباد سنة اثني اربعين وسبعماية

## VII.—IKHTIAR-UD-DYN. GHAZI SHAH.

At the period of this king's accession to the sovereignty of Sonárgaon in A. H. 750 or 751, we lose the aid of our most trustworthy recorder of the annals of Bengal during his own time. The conclusion of Ibn Batutah's narrative leaves Fakhr-ud-dín Mubárak still in power, while the native authorities are clearly at fault in their arrangement of dates and events, and altogether silent as to any change in the succession in Eastern Bengal, except in their allusions to the more than problematical capture of Fakhr-ud-dín and his execution by 'Alí Mubárak in 743 A.H., with the final accession of Ilías "one year and five months afterwards."\*

The numismatic testimony would seem to show that Mubárak was succeeded by his own son, as the *Ul Sultán bin Ul Sultán* may be taken to imply. The immediately consecutive dates, and the absolute identity of the fabric of the coins, as well as the retention of the style of Right-hand of the Khalifat on the reverse, alike connect the two princes; while the cessation of the issues of Ghází Sháh simultaneously with the acquisition of Sonárgaon by Ilías, in A.H. 753, would seem to point to the gradual spread of the power of the latter, which is stated to have been at its zenith just before Fírúz III. assailed him in his newly consolidated monarchy in 754.†

\* Stewart, p. 88.

† Shams-i-Siráj, speaking on hearsay, affirms that Shams-ud-dín Ilías captured and slew Fakhr-ud-dín after Fírúz III.'s first expedition into Bengal, and that the main object of the latter's second invasion of that province was for the purpose of reasserting the rights of Zafar Khán, the son-in-law of Fakhr-ud-dín (who had fled for protection to Delhi), to the kingdom of Eastern Bengal. It is asserted that although Fírúz succeeded in obtaining this concession from Sikandar, who, in the interval, had succeeded to his father's throne, Zafar Khán himself was wise enough to decline the dangerous

Ikhtár-ud-dín. Ghází Sháh. •

No. 13.

Sonárgaon, A.H. 751-753.

Silver. Size, vi. Weight, 166 grs. Very rare indeed. Three coins, *Col. Guthrie*. Plate I. fig. 9.

Obv.

Rev.

السلطان الاعظم  
اختيار الدنيا والدين  
ابو المظفر غازي شاه  
السلطان بن السلطان

يمين الخليفة  
ناصر امير  
الومنين

Margin,

ضرب هذه السكة بحضرة جلال سزار كانو منه احدي وخمسين وسبعماية

## VII.—SHAMS-UD-DIN. ILIÁS SHAH.

The modern application of old coins divides itself into two branches—the suggestive development of obscure tradition, and the enlargement and critical revision of accepted history. The transition point between these archæological functions, in the present series, declares itself in the accession of Iliás Sháh, the first recognised and effectively independent Moslem Sultán of Bengal, the annals of whose reign have been so often imperfectly reproduced in prefatory introductions to the relation of the magnificent future his successors were destined to achieve as holders of the interests and the commercial prosperity of the Delta of the Ganges, to whose heritage, indeed, England owes its effective ownership of the continent of India at the present day.

proximity to so powerful a rival monarch, and to return in the suite of the Sultán. The Bengálí troops, under Zafar Khán, subsequently distinguished themselves in an opposite quarter of India, near Tattah, and their commander was eventually left in charge of Guzerát.—*Shams-i-Siráj*, book ii, cap. 9, etc.—See also *Journal Archæological Society of Dehli* (Major Lewis's abstract translation), 1849, p. 15.

The *Tárikh-i-Mubárák Sháhi* (dedicated to Mubárák II.), the concluding date of which is 838 A.H., also declares that Háji Iliás killed Fakhr-ud-dín in 741 A.H. This last date is a manifest error; as is also, probably, the omission, by both authors, of the words *son of* before the name of Fakhr-ud-dín.

The compiler\* of the English version of the early history of Bengal\* adopts the conclusion that Hájí Ilías first obtained power on the assassination of " 'Ali Mubarak" in 745-6, but the previous rectification of the independent\* personality and status of the two individuals thus singularly absorbed into one, will prepare the reader for the corrections involved, though not, perhaps, for the apparent anomalies the coins disclose. Medallie testimony would seem to indicate a long waging of hostile interests between the real 'Alí Sháh and Hájí Ilías, before the latter attained his final local triumph; for although Ilías is seen to have coined money in Fírúzábád in 740 A.H., the chance seems to have been denied him in 741; and in 742 his adversary, 'Alí Sháh, is found in full possession of the mint in question. The Kooch Bahár hoard reveals no coin of either party dated 743, but in 744 the two again compete for ownership, which 'Alí Sháh for the time being continues through 745 into 746, when the annual series is taken up and carried on successively for an uninterrupted twelve years by his more favoured opponent. It is needless to speculate on the varying course of these individual triumphs; suffice it to say, that the increasing power of the ruler of Pandua, in 754, excited the Emperor Fírúz III, to proceed against him in all the pomp and following of an Oriental suzerain, resulting only in the confession of weakness, conveniently attributed to the periodical flooding of the country†—which effectively laid

\* Stewart, p. 83.

† Stewart felt a difficulty about the right position of *Akdallah*, the real point of attack, and a place of considerable importance in the local history of Bengal. The following is Zia-i-Barni's description of the place, taken from the concluding chapters of his history on the occasion of Fírúz Sháh's (III.) invasion of Bengal in 754 A.H. :—

واكداله نام موضعي است نزديك پندوة كه يك طرف آن آب است

و طرف دوم جنگل است در آن اكداله نحصين كرد و از پندوة مردم كارآمده

P. 588, printed edit. در اكداله برد

Rennell gives another Akdallah north of Dacca. "Map of Hindoostan."

In the following passage Shams-i-Siráj desires to make it appear that Fírúz III. gave his own name to the city of Pandua; but, as we have seen that the designation was applied to the new capital either in 740 or 742—that is, long before Fírúz became king of Dehli, it will be preferable to conclude that the name was originally bestowed in honour of the Shams-ud-din Fírúz of Bengal, of the present series. The quotation is otherwise of value, as it establishes, beyond a doubt, the true position of the new metropolis :—

( فيروز شاه ) در پندوة رسيد در آن مقام خطبه بنام حضرت فيروز شاه

the foundation of the ultimate independence of Bengal. A monarchy which was destined so to grow in power and material wealth as to be competent, indirectly, in the person of Shír Sháh, to recover for the old Muhammadan interest the cherished capitals of the north, and to eject from Hindustán the Moghuls who too hastily boasted of an easily-achieved conquest of the country "from Bhíra to Bahár."

*Shams-ud-din. Ilías Sháh.*

No. 14.

Fírúzábád, A. H. 740, 744, 746, 747, 748, 749, 750, 751, 754, 755, 756, 757, 758.

Silver. Size, vii. Weight, selected specimens, 168.0 grs.; ordinary weights, 166.0 grs.

Type No. 1. The old Dehli pattern.

*Obverse*, Square area.

*Reverse*, Square area, within a circle.

Obv.

Rev.

السلطان الغازي  
شمس الدنيا والدين  
ابو المظفر الياس  
شاه السلطان

مكندر ثاني  
يمين الخلافة ناصر  
امير المومنين

Margin,

ضرب هذه الفضة السكة في البلد فيروزآباد سنة اربع وخمسين وسبعماية

Type No. 1. Variety A. Silver. Size, vii. Weight, 166 grs.

*Obverse*, Lettered surface.

*Reverse*, Small circle, area.

No. 15.

Fírúzábád, A. H. 758.

Type No. 2. Broad coin. Size, ix. Weight of the best and selected specimens, 166.0 grs. only.

*Obverse*, Plain lettered surface.

*Reverse*, Circular area, with narrow margin.

خواندند و نام شهر فیروز آباد نهادند چون سلطان فیروز شاه اكداله را  
آزاد پور نام كرد و شهر پندوة را فیروز آباد . . . . (hence) آزاد پور  
عرف اكداله و فیروز آباد عرف پندوة

From the original MS. in the possession of Zia' ud-din Khán of Lohárú.

Legends, both obverse and reverse as in No. 1 type.

Marginal legend,

ضرب هذه السكة بحضرة فيروز آباد سنة ثمان وخمسين وسبعماية

The Kooch Bahár trove must have been rich in this type of coin, and of the particular year A. H. 758, as out of 109 specimens in Col. Guthrie's collection, there is no single example of any other date.

No. 16.

Sonárgaon, A. H. 753, 754, 755, 756, 757, 758.

Type No. 3. Size, vii. Present weight, 166 grs. after the obvious reduction by boring out. Plate II., fig. 10.

Obverse, Square area.

Reverse, Circular area, with broad margin.

OBV.

REV.

السلطان العادل

شمس الدنيا والدين

ابو المظفر الياق

شاه السلطان

مكندر الثاني

يمين الخلافة

امير المؤمنين

Margin,

ضرب هذه السكة بحضرة جلال سنار كانو سنة خمس وخمسين وسبعماية

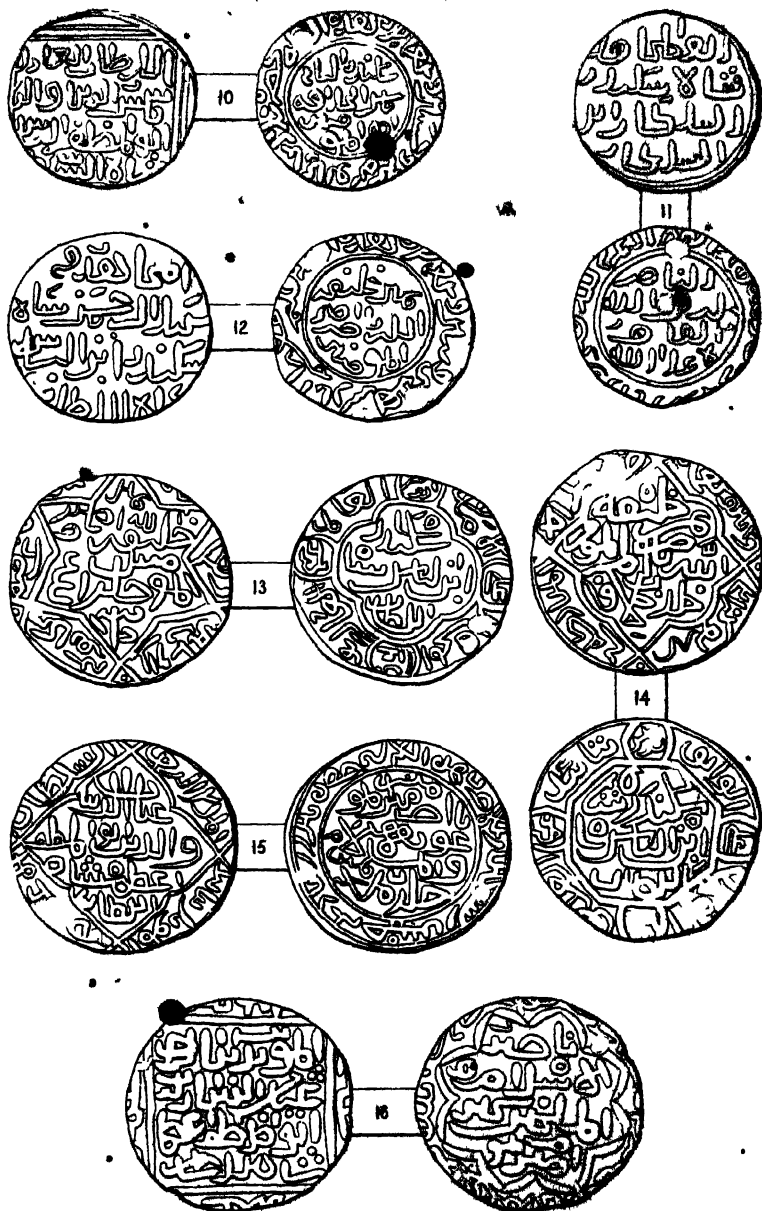
#### IX.—SIKANDAR BIN ILI'AS.

This king—the second only in the still incomplete assertion of local independence of allegiance to the throne of Dehli—exhibits in the material wealth of his national coinage the striking progress incident to comparative freedom and identity of home interests, which may be achieved, almost on the instant, by the denizens of a commercial centre so favoured by nature as the Delta of the Ganges.

Tried by such a test, few statistical returns could present more effectively the contrast disclosed in the Kooch Bahár treasure between the accumulated produce of the Bengal Mints, representing a century and a quarter's limited activity, attended with all the advantages of a diffused circulation, but under a subordinate government, as compared with the overwhelming array of coins bearing the impress of a single unfettered monarch, whose money was, in effect, new from the dies. To numismatists the enhanced proportion will be

# BENGALESE COINS

PL. II.







more significantly shown by a reference to the additional number of Mint-cities, the singular variety of new types produced, and above all, by the sustained series and corroborating repetitions of annual dates. • It is under the latter aspect alone that I have now to comment on the history of a reign already sufficiently told in other pages. Sikandar Sháh placidly succeeded his father towards the end of 759 A.H., and the coins of the period sufficiently support the date of such a transfer of power, in the final year 758 recorded on the issues of the father, though proof of the accession of the son is less marked, as the seeming anomaly obtained—under the conjoint efforts of father and son to achieve release from thralldom to a distant suzerain—of a concession to the son of much independent power, and, coincidently, the right to coin money in his own name, whether in his own camps or in his father's royal cities. Though some of the earlier designed coins give evidence of due humility in titular phraseology, the same simplicity is adhered to, in continuous mintages, long after the removal of any possible impediments or restrictions to the adoption of comparatively exalted titles; though in the more independent governmental mintages of 758 A.H. (No. 21) the *السلطان المعظم* is affected even during the life-time of the father, and, after his own accession, higher assumptions, and a more definite approach towards personal hierarchical honors, are discovered in the metropolitan issues of 766-780 (No. 22), while special service against the infidels seems to be implied in the novel intitulation of *القاهر الاعداء الله* "The conqueror of the enemies of God," on the Fírúzábád money of 769 A.H. (No. 23).

But the most interesting details furnished by Sikandar's coins are those which illustrate the geographical distribution of the chief seats of government. Unlike the Northern Moslems, who, in the difficulty of moving the Eastern hosts—conventionally deemed essential to an Imperial progress—over the imperfect highways of Hindustán, confined themselves ordinarily to one fixed metropolis, the kings of Bengal enjoyed facilities of river communication almost unprecedented: their various capitals, situated within easy distance of one another, were at all times accessible by water,—a differently constructed State barge secured at any season free approach to the seaboard cities of the Great Ganges or the towns on the narrow channels of the western streams. These frequent regal visitations are incidentally

recorded on the coinage of the day, by the insertion of the prefix of حضرت to the name of the selected residence, which term colloquially marked the presence of royalty within the limits of the favoured fiscal division.

Sikandar's mint cities were five in number—No. 2, *Firúzábád*; 3, *Satgaon*; and 4, *Shahr Nau*, in Western Bengal; with 5, *Sonárgaon*; and 6, *Muazamábád*, in the Eastern division of the province.

2. The first-named mint, in addition to the preferential *Hazrat*,\* is styled variously *Baldut* and بلدة المحروسة “fortified city,” a specification which probably refers to the separate though closely proximate citadel of *Akdálah*, so celebrated in the military annals of the time (coin No. 26).

3. *Satgaon* is distinguished by the prefix of عَرَمَة (*Atrūm*) a term which, in India, came to be conventionally used for a tract or geographical division of country,† a sense which would well accord with its application to *Satgaon*, as the third circle of government of Bengal proper.‡ In the subsequent reign of Aazam the mint specification is more directly brought into association with the town itself in the seemingly more definite localization involved in the word قَصَبَة §

4. *Shahr Nau*, I suppose to have been the intitulation of the new city founded near the site of the old *Lakhnauti*:|| it is variously denominated as the simple 'Arsat عَرَصَة المعورة (populous, richly

\* حَضْرَة “Præsentia, Majestas; urbs, in qua est regis sedes.”

† عَرَمَة زمین in Persian, means “surface of the earth.” Sir Henry Elliot remarks, “The words used before Akbar's time to represent tracts of country larger than a *Pergunnah* were سق, خطه, عرصه, ديار, ولايت, and اقطاع

—Glossary of Indian Terms, *sub voc* “Circár.”

‡ Zia-i-Barni, in introducing his narrative of Tughlak Sháh's expedition to Bengal (A. H. 724), speaks of that province as consisting of the three divisions “*Lakhnauti*, *Sunárgaon*, and *Satgaon*” (p. 450, printed edit.).

The *Ayín-i-Akbari*, in the xvi. cent. A. D. thus refers to *Satgaon*, “There are two emporiums a mile distant from each other; one called *Satgaon*, and the other *Hoogly* with its dependencies; both of which are in the possession of the Europeans.”—Gladwin, ii. p. 15. See also Rennell, p. 57. Stewart's Bengal, pp. 186, 240, 243, 330.

§ From قَصَب “amputavit:” hence قَصَبَة “oppidum, *vel* potior, præcipua pars oppidorum.”

|| The decipherment of the name of this mint (as Col. Yule reminds me) determines for mediæval geography the contested site of Nicolò Conti's *Cernove*. The Venetian traveller in the East in the early part of the fifteenth

cultivated).\* This progressively less appropriate name may be supposed to have merged into the official Jannatábád, which follows in Mint sequence.

5. *Sonárgaon*, as a rule, retains its ancient discriminative designation of *حضرة جلال*, a title which it eventually had to cede to its rival Muazamábád.

6. *Muazamabad*. There is no definite authority for the determination of the site of this city, which, however, seems to have been founded by Sikandar about 758-759 A. H., when his own coins record that he himself assumed the title of *المعظم*, without trenching upon the superlative *الاعظم* usually reserved for the reigning monarch. I conclude that there was a gradual migration from the ancient Sonárgaon to the new city, which grew in importance from the governmental centre implied in the *اقليم معظم اباد* (No. 19) of 760 A. H., to the *بلدة المعظم معظم اباد*, "the great city of Muāzamábád" (No. 18) of about 780 A. H., till, on the disappearance of the name of Sonárgaon

century is recorded to have said that "he entered the mouth of the river Ganges, and, sailing up it, at the end of fifteen days he came to a large and wealthy city called Cernove . . . . On both banks of the stream there are most charming villas and plantations and gardens. . . . Having departed hence, he sailed up the river Ganges for the space of three months, leaving behind him four very famous cities, and landed at an extremely powerful city called Maarazia . . . having spent thirteen days 'on an expedition to some mountains to the eastward, in search of carbuncles' . . he, returned to the city of Cernove, and thence proceeded to Buffotania."—The travels of Nicoló Conti, Hakluyt Society, London, pp. 10, 11.

See also Purchas, vol. v. p. 508; and Murray's Travels in Asia, ii. 11.

There are also many interesting details regarding the geography of Bengal, and a very full and lucid summary of the history of the period, to be found in "Da Asia de João de Barros" (Lisbon, 1777, vol. iv. [viii.], p. 465 *et seq.*). At the period of the treaty of Alfonso de Mello with, "El Rey Mamud de Bengala" (the king whom Shir Sháh eventually overcame) the name of Shahr Nau had merged into the old provincial designation of *Gaur*, which is described as "a principal Cidade deste Reino he chamada *Gouro*, situada nas correntes do Gange, e dizem ter de comprido tres leguas, das nossas, e duzentos mil vizinhos," (p. 458). Satigam makes a prominent figure on the map, and Sornagam is located on a large island within the Delta, the main stream dividing it from Daca, which is placed on the opposite or left bank of the estuary.

More modern accounts of the old city may be found in Purchas, i. 579; Churchill, viii. 54; also Rennell, Memoir of a Map of Hindoostan, London, 1788, p. 55; Stewart, p. 44, and in a special work entitled "The Ruins of Gour," illustrated with maps, plans, and engravings of the numerous Muhammadan edifices extant in 1817, by H. Creighton, 4to., London, Black, Parbury and Allen. See also Elliot's Glossary of Indian Terms, *sub voce*, Gour Brahmin.

\* The adjective (derived from *عمر*, Coluit) will admit of other meanings, and if understood as applying to a town, might signify "well built," locally *Pakka*.

from the marginal records of the general currency, the new metropolis appropriates to itself the immemorial *حضرة جلال* of Eastern Bengal (No. 32 A.)

With a view to keep these brief geographical notices under one heading, I advert for the moment to No. 7, *Ghiaspur*, of which locality I have been able to discover no trace; and likewise anticipate the due order of the examination of Aāzem Shāh's mint cities in referring to the sole remaining name of *Jannatābād*, an epithet which is erroneously stated to have been given by Humāyūn to the re-edified Lakhnaūti,\* but which is here seen to have been in use a century and a half before the Moghuls made their way into Bengal.

The single item remaining to be mentioned in regard to Aāzam's mints is the substitution of the word *قصة* in lieu of *بلدة*† as the prefix to Fīrūzābād (No. 35), in parallel progress towards centralization with the Mint phraseology adopted in the case of Satgaon.

Sikandar Shāh *bin Ilias Shah*.

No. 17.

Fīrūzābād, A. H. 750, 751, 752, 753, 754, 758, 759, 760.

Type No. 1. Ordinary simple obverse, with reverse circular are a and margin.

| OBV.          | REV.    |
|---------------|---------|
| مكندر شاه     | المجاهد |
| ابن الياس شاه | في سبيل |
| السلطان       | الرحمن  |

Margin,

صرب هذا الفضة السكه في البلدة فيروز اباد منه ثلاث وخمسين وسبعماية

\* *Ayfn-i-Akbari*, ii. p. 11; Stewart's Bengal, 124. Bengal itself was called

*جنة البلاد*, "The Paradise of Regions." Ibn Batutah, iv. p. 210, says the Persians called Bengal *بور نعمة*, "دوزخ", "oe qui signifie," en arabe, "un enfer rempli de biens." Marsden, Num. Orient. p. 578, gives a coin of 'Alā-ud-dīn Husain Shāh, of A. H. 917, purporting to have been struck at "*Jannatabad*."

† *بلد* "regio;" also "oppidum." The plurals are said to vary, in correspondence with the independent meanings, as *بلدان* and *بلدان*.

## No. 18.

Sonárgaon, A. H. 756, 757, 759, 760, 763.

Type No. 2. The usual lettered obverse with circular area and margin reverse.

| Obv.                                                 | Rev.           |
|------------------------------------------------------|----------------|
| المجاهد في                                           | يمين خليفه     |
| سبيل الرحمن                                          | الله ناصر امير |
| سكندر شاه ابن الياس                                  | المومنين       |
| شاه السلطان                                          |                |
| Margin,                                              |                |
| ضرب هذه السكه بحضرة جلال سنارگانو سنه ستين و سبعماية |                |

## No. 19.

Muâzamâbâd, A. H. 760, 761, 763, 764. . Plate II. fig. 12.

Variety A.

Margin,

ضرب هذه السكه اقليم معظم اباد سنه احدى و ستين و سبعماية

## No. 20.

Fîrúzâbâd, A. H. 764.

Variety B.

## No. 21.

Sonárgaon, A. H. 758, 759.

Type No. 3. As usual.

| Obv.           | Rev.           |
|----------------|----------------|
| السلطان المعظم | يمين خليفه     |
| سكندر شاه      | الله ناصر امير |
| ابن الياس شاه  | المومنين       |
| السلطان        |                |

Margin, as usual.

## No. 22.

Fîrúzâbâd, A. H. 765, 766, 770, 771, 772, 773, 776, 779, 780.

Type No. 4. Coarse coins, badly formed letters. *Obverse*, simple lettered surface. *Reverse*, circular area.

| OBV.          | REV.           |
|---------------|----------------|
| الامام        | يمين خليفه     |
| الاعظم ابو    | الله ناصر امير |
| المجاهد سكندر | المومنين       |
| شاه ابن الياس | خلد الله خلافة |
| شاه السلطان   |                |

هذه السكة بحضرت فيروز اباد سنة سبعين و سبعمائة

No. 23.

Firuzabad, A. H. 769.

Silver. Size, vii. Weight, 166 grs. Very rare. Plate II. fig. 11.

Type No. 5. Similar design to type 1.

| OBV.        | REV.       |
|-------------|------------|
| ابوالمجاهد  | الناصر     |
| سكندر شاه   | الدين الله |
| السلطان ابن | القاهر     |
| السلطان     | لاعد الله  |

Margin,

ضرب هذا الفضة السكة في البلدة فيروز اباد سنة سبع و ستين و \*

No. 24.

Satgaon, A.H. 780, 781, 782, 783, 784, 788. Plate II. fig. 13.

Type No. 6. *Obverse*, a quadrated scalloped shield, with open bosses on the margin containing the names of the "four friends," the intermediate spaces being filled in partially with the king's titles.

*Reverse*, hexagonal star-shaped lozenge, with exterior marginal legend.\*

\* The pattern legend of this mint-die seems to have been taken from oral data, as it is engraved as الله القاهر لاعد instead of the more critical الله لاعد

القاهر الله The increased facilities of intercourse by sea probably aided the colloquial knowledge of Arabic in the estuaries of Bengal; while the learned of Dehli had to rely more upon books and occasional teachers. Ibn Batutah tells us, that Muhammad bin Tughlak, though pretending to speak Arabic, did not distinguish himself in the act, while *Hajj* Iltas must himself have performed the pilgrimage to Mecca.

OBY.

سكندر شاه  
ابن الياس شاه  
السلطان

REV.

يمين  
خليفه الله ناصر امير  
المومنين خلد الله  
خلافة

*Obverse Margin,*

الاصام العالم العادل ابو المجاهد — ابوبكر عمر عثمان علي

*Reverse Margin,*

ضرب هذه السكه المباركه في عرصه سكتانوسنه احد وثمانين وسبعماية

No. 25.

Shahr Nau, A. H. 781, 782, 783, 784, 785, 786 Plate II. fig. 14.

Type No. 7. *Obverse*, a simple octagon, with four circlets in the margin containing the names of the four friends of the Prophet, the rest of the exergue being filled in with the king's own titles.

*Reverse*, a diamond-shaped area with the crossed lines prolonged to the edge of the piece; the lines are slightly scalloped outwards to form an ornamental field.

OBY.

سكندر شاه  
ابن الياس شاه  
السلطان

REV.

يمين خليفه  
الله ناصر امير المومنين  
خلد خلافة

*Obverse Margin,*

ابوبكر عمر عثمان علي الوثق بتايد الرحمن ابو المجاهد

*Reverse Margin,*

ضرب هذه السكه المباركه في عرصه شهرنو سنه اثني وثمانين وسبعماية

The name of the mint is imperfectly expressed on even the best specimens, and great latitude has been permitted in the omission or insertion of entire words in the reverse marginal legend.

Variety A. differs merely in the pattern of the reverse area, which is ornamented with double instead of single scallops.

No. 26.

Fírúzábád, A. H. 780, 781, 782, 783, 784, 785, 786, 787, 788, 789,  
790, 791, 792.

Type No. 8. *Obverse*, circular area, with a board margin divided

by circlets enclosing the names of the four friends of the Prophet, the intermediate spaces being filled in with their titles.

*Reverse*, octagonal rose scalloped lozenge, with narrow margin.

*Obverse*,

الوائق بقائيد الرحمن ابوالمجاهد سكندر شاه ابن الياس شاه السلطان

Margin,

ابوبكر الاعظم عمر ابوالخليفة عثمان المعظم علي الامام

*Reverse*,

يمين الخليفة ناصر امير المؤمنين عون \* الاسلام والمسلمين خلد خلافته

Margin,

ضرب هذه السكة المباركة في بلدة المعمورة فيروزاباد سنة ثمانين وسبعماية

No. 27.

Satgaon, A. H. 780.

Variety A. *Reverse* Margin,

ضوب هذه السكة المباركة في عرصه المعمورة ستكانو etc.

No. 28.

Muazamábád (the great city), A.H. ?

Variety B. Mint,

بلدة المعظم معظم اباد

No. 29.

Shahr Nau, A. H. 781.

Variety C. Mint, عرصه المعمورة شهر نوسنه احد وثمانين

No. 30.

Col. Guthrie has a gold piece of type No. 8, size vii. and a half, weighing 158 grains. The coin is inferior in execution to the ordinary silver money. The letters are badly formed, and the marginal legend is altogether obliterated.†

No. 31.

Firúzábád, A. H. 781, 782, 783, 784, 785, 786, 787.

Type No. 9. *Obverse*, circular area, with a broad margin, broken

\* M. Reinand interpreted the word as عون, *Defensor* (Journal Asiatique, 1823, p. 272), in which he is followed by Marsden (ii. p. 567). Sayud Ahmad again, in his transcript of 'Ala-ud-din's Inscription of 710 A. H., reproduces the title as غوث الاملا والمسلمين, which, in effect, carries a nearly identical meaning (Asar-ul-sunadid, p. 58).

† The only other Bengal gold coins I am at present able to refer to are a well-preserved piece of Jalál-ud-din Fatah Shah bin Mahmud (dated A. H. 890), now in the possession of Colonel Guthrie, weighing 161.4 grains, and a coin in the B.M. assigned to 'Ala-ud-din Husain (A. H. 905-927) which weighs 159.5 grains.



by small shields containing the names of the four companions of the Prophet ; the intermediate spaces are filled in with titles which occasionally pertain to the king, but at times exclusively belong to the Imáms.\*

*Reverse, hexagonal field ; narrow margin.*

| Obv.                | Rev.                    |
|---------------------|-------------------------|
| ابو المجاهد         | يمين خليفة              |
| سكندر شاه ابن الياس | الله ناصر امير المؤمنين |
| شاه السلطان         | عون الاسلام والمسلم     |
|                     | خالد ملك                |

*Obverse Margin,*

الامام ( ابو بكر ) الاعظم ( عمر ) الراثق ( عثمان ) بتائيد الرحمن ( علي )

*Reverse Margin,*

ضرب هذه السكه المباركه في بلدة فيروز اباد سنه ست وثمانين وسبعماية

#### X.—A'AZAM SHAH.

The accession of Ghíás-ud-dín Aazam Sháh was disgraced by rebellion against his own father and coincident open war, in the course of which Sikandar fell in a general action between his own and his son's troops. Native historians are more than ordinarily obscure in the narration of these incidents, and the dates relied upon are singularly untrustworthy, when brought to the test of numismatic facts. Aazam's initial revolt is admitted to have gained force chiefly in Eastern Bengal, where his coinage substantially proves his administrative supremacy, whether as nominally subordinate or covertly resistant to paternal authority, dating from 772 A. H.,—an increase of power seems to be associated with the mint record of a hold over Satgaon in 790 A. H., and a real or pretended occupancy of a portion of the territory of Pandua in 791, though the final eclipse of the royal titles of the father is delayed till 792 A. H.†

\* *الرائق* in many instances is replaced by *وابو الخليفة*, while *المعظم* follows the name of *عثمان*.

† Stewart supposes that Sikandar met his death in 769 A. H. (p. 89) ; and an even more patent error places the decease of A'azam in 775 A. H. (p. 93). The *Tabakát-i-Akbari*, which devotes a special section to the history of Bengal, implies an amiable and undisturbed succession in this instance.

Ghíás-ud-dín Aazam Sháh, bin Sikandar Sháh.

No. 32.

Muazamábád, A. H. 772, 775, 776.

Silver. Size, viii½. Weight, 166 grs. Plate II. fig. 16.

Type No. 1. *Obverse*, square area occupying nearly the whole surface of the coin, as in the old Dehli pattern.

*Reverse*, scalloped lozenge, forming an eight-pointed but contracted star.

| OBV.                 | REV.           |
|----------------------|----------------|
| الموید بتائید الرحمن | ناصر الاسلام و |
| غیاث الدینا و الدین  | المسلمین کین   |
| ابو المظفر اعظم شاه  | امیر المومنین  |
| السلطان              |                |

*Obverse Margin*: On the upper edge, ابوبکر; on the left, عمر; in consecutive reading at the foot, عثمان; and on the right, علي.

*Reverse Margin*,

هذه السكة المباركة في بلدة معظماباد سنة ثمان و سبعين و سبعماية

Variety A. In one instance بحضرت جلال supplies the place of في بلدة.

There is a doubt about the reading of the word كین "being humble;" the عین "Oculus" of Marsden would certainly be preferable in point of sense, but the forms of the letters of the word scarcely justify such a rendering, unless we admit of an unusual degree of even Bengálí imperfection in the fashioning these dies.

On two examples of this mintage *in silver*, the marginal legend bears the words هذه الدينار in clearly cut letters; but I imagine this seeming anomaly to have arisen from a fortuitous use of the dies for gold coins, which, in device, were identical with those employed for the silver money.

No. 33.

Jannatábád, A. H. 790.

Variety A. Similar obverse with circular reverse.

Mint. جنناباد سنة تسعين و

REV.

OBV.



No. 34.

Type No. 2. There is a subordinate class of coins, following the devices of Type No. 1 (in size vii. and upwards), struck from less expanded dies, and generally of very inferior execution in the outlining of the letters. These are also from the mint of Muazamábád, and are dated in bungled and almost illegible words *سبعو سبعماية وثمانو سعو*, —which may be designed to stand for 770 odd, 778, 780, and 781 respectively.

No. 35.

Fírúzábád, A. H. 791, 792, 793, 794, 795, 796, 797, 798, 799.

Type No. 3. Size, viii. to viii $\frac{1}{4}$ . Weight, 166 grs. Plate II. fig. 15.

*Obverse*, scalloped diamond field ; broad margin.

*Reverse*, circular area.

OBV.

غياث الدنيا

والدين ابو المظفر

اعظم شاه

السلطان

REV.

ناصر امير

المومنين عون الاسلام

والمسلمين

خلد ملكه

*Obverse Margin*, السلطان الاعظم المريد بتايد الملك الرحمن

*Reverse Margin*,

هذه السكة بقصبة فيروزاباد سنة ثلاث وتسعين وسبعماية

The Reverse marginal records vary in the prefix to the name of the mint from the Kasbah above given, *في حضرة المباركة* and *في حضرة* being occasionally used.

No. 36.

Satgáon, A. H. 795, 798.

Variety A.

No. 37.

Satgáon, A. H. 790, 795, 796.

Type No. 4. *Obverse*, area, a square, with a looped semicircle at each of the sides, forming a kind of amalgamation of the margin with the central device.

*Reverse*, area, a four-pointed star-shaped lozenge; the outside spaces being filled in with the marginal legend.

| OBV.                 | REV.           |
|----------------------|----------------|
| ابوبكر               | ناصر الاسلام و |
| الموید بتائید الرحمن | المسلمین کین   |
| غیاث الدین و الدین   | امیر المومنین  |
| ابو المظفر اعظم      |                |
| شاه السلطان          |                |
| شاه                  |                |

*Reverse Margin*,

ضرب هذه السكة • • في عرصة سئكانو سنة تسعين و سبعمائة

No. 38.

Type No. 5. Size, v. Weight, 166 grains.

*Obverse*, lettered surface.

*Reverse*, circular area; narrow margin.

| OBV.              | REV.           |
|-------------------|----------------|
| غیاث الدین        | ابد الله       |
| والدين ابو المظفر | خلد الله دولته |
| اعظم شاه          | ملكه           |
| السلطان           |                |

Margin? • معظم آباد سنة احد

The singular orthography adopted in the rendering of the term *Abdallah*, and the substitution of an initial *alif* in lieu of the grammatical *ain*, affords another instance of the ignorance of the local mint officials, and their tendency to reproduce the approximate *sounds* of words, without regard to the true powers of the letters employed.

A vacant space in the final setting up of this article invites me to extend it so far as to notice a limited series of coins which have hitherto

been erroneously associated with the mintages of Bengal proper,—I allude to the money of Táj-ud-dín Firúz, whose date has, in like manner, been misapprehended by Marsden (p. 575), and by Mr. Laidlay, who follows his interpretation (J. A. S. B. xv. p. 330). The subjoined examples will show that the supposed date of 897 A. H. should be 807; and the consecutive numbers on the different coins now cited establish the fact that the potentate whose name they bear reigned at least from 804 to 823, having a capital entitled *Hájíábád*, which may with sufficient reason be identified with the *Hájípur* of modern nomenclature. The introductory piece A. seems to have been issued by Táj-ud-dín's predecessor, and their several mintages alike depart from the ordinary style of Bengal coinages in the phraseology and finished execution of the Arabic legends, as well as in the weights of their currencies, which approximate closely to the full Dehli standard, in contrast to the reduced southern range of 166 grains.

A. Silver. Size, vii½. Weight, 165 grs. Unique. A. H. 797.

| OBV.          | REV.              |
|---------------|-------------------|
| الناصر لدين   | الوائق بتايد      |
| لدنان الحامي  | الرحمن ابو المظفر |
| الاهل الايمان | محمد شاه السلطان  |
|               | ٧٩٧               |

B. Silver. Size from vi½ to viii½. Weight, 168 grs., the full and sustained weight of several specimens.

| OBV.                | REV.         |
|---------------------|--------------|
| سلطان               | تاج الدنيا   |
| العهد والزمان       | والدين فيروز |
| الوائق بتايد الرحمن | شاه السلطان  |
| ابو المظفر          | ٨٠٤          |

*Obverse*, lettered surface.

*Reverse*, square area, with imperfect marginal records, usually consisting of حضرت حاجبا باد with the figured dates at the foot, rang-

ing onwards from 804 to 807 [Marsden], 810, 813, 814, 818, 819, 820, 822, and 823 A. H.

These coins are chiefly from the collection of the late Sir R. Jenkins, but have now passed into Colonel Guthrie's possession.

Among other rare and unpublished coins, having more or less connexion with the progress of events in Bengal, I may call attention to the subjoined piece of Shír Sháh (C.), which seems to mark his final triumph over Humáyún in 946 A. H. and his own assumption of imperial honours in Hindustán. The gold coin (D.) is of interest, as exhibiting the model from whence Akbar derived one of his types of money, which Oriental authors would have us believe were altogether of his special origination, even as they attribute so many of Shír Sháh's other admirable fiscal and revenue organizations to his Moghul successor. In coin E. we follow the spread of Shír Sháh's power northwards to the ancient capital of the Patháns, and the piece F. illustrates the retention of the family sway over the other extreme of the old dominion.

C. Silver. Size, vi $\frac{1}{4}$ . Weight, 163 grs. A. H. 946. Well executed Western characters.

*Obverse*, السلطان العادل المريد بقائيد الرحمن فريد الدنيا والدين

*Reverse*, ابوالمظفرشيرشاه سلطان خلد الله ملكه و سلطانه ٩٤٦

D. Gold. Square coin. Weight, 168 $\frac{1}{2}$  grs Unique. (R. J. Brassey, Esq.).

*Obverse*, the Kalimah.

*Reverse*, شیر شاه سلطان خلد الله ملكه

At the foot, श्रीमैर साह.

E. Silver. Size, vii. Weight, 168 grs. Dehli. A. H. 948.

*Obverse*, Square area. لا اله الا الله محمد رسول الله

Margin, the names and titles of the four Imáms.

*Reverse*, Square area. السلطان شیر شاه خلد الله ملكه ٩٤٨

At the foot, बीसीरी साह

Margin, ضرب بمحضرت دهلي \* \* \*

F. Silver. Size, viii. Weight, ? Satgáon, A. H. 951 (from the collection of the late G. H. Freeling, Bengal C. S.)

Circular area, اسلام شاه ابن شیر شاه سلطان خلد الله ملكه و

سلطانه و اعلي امرة و شانه

Margin,

جلال الدنيا والدين ابوالمظفر شاه رحمان شاه ضرب سگانو ٩٥١

| BENGAL MINTS.                                         |                      |                  |                 |                  |                                        |                  |
|-------------------------------------------------------|----------------------|------------------|-----------------|------------------|----------------------------------------|------------------|
|                                                       | 1.<br>Lakhnauti.     | 2.<br>Firuzabad. | 3.<br>Satgaoon. | 4.<br>Shahr Nau. | 5.<br>Sonargaon.                       | 6.<br>Muzamabad. |
| I. Kai Kaus .....                                     | A.N. 691.....695     | ... ..           | ... ..          | ... ..           | ... ..                                 | — ..             |
| II. Shams-ud-din .....                                | 702.....722          | ... ..           | ... ..          | ... ..           | in possession.                         | — ..             |
| III. Shahab ud-din .....                              | ... ..               | ... ..           | ... ..          | ... ..           | • ... ..                               | — ..             |
| IV. Bahadur Shah .....                                | 710, 712.....720-722 | ... ..           | ... ..          | ... ..           | IV. Under Muhammad<br>bin Tughlak, 728 | — ..             |
| Muhammad bin Tughlak (himself)                        | .....783             | ... ..           | ... ..          | ... ..           | ... ..                                 | — ..             |
| V. Mubarak Shah .....                                 | ... ..               | ... ..           | ... ..          | ... ..           | 737 ..... 741 to 750                   | — ..             |
| VI. 'Ali Shah .....                                   | ... ..               | 742.....746      | ... ..          | ... ..           | ... ..                                 | — ..             |
| VII. Ghazi Shah .....                                 | ... ..               | ... ..           | ... ..          | ... ..           | 751.....753                            | — ..             |
| VIII. Ilias Shah .....                                | ... ..               | 740.....758      | ... ..          | ... ..           | 753.....758                            | — ..             |
| IX. Sikandar Shah .....                               | ... ..               | 750.....792      | 780.....784     | 781—...786       | 756.....764                            | 760—764          |
| X. Azam Shah .....                                    | ... ..               | 791.....799      | 790 .....798    | — —              | ... ..                                 | 772—781          |
| Mint No. 7. Ghiaspur..... IV. Bahadur Shah, 730 A. H. |                      |                  |                 |                  |                                        |                  |
| Mint No. 8. Jannatabad..... X. Azam Shah, 790 A. H.   |                      |                  |                 |                  |                                        |                  |

*Notes on the Jumma Masjid of Etawah.—By C. HORNE, Esq.*

[Received 5th April, 1866.]

Proceeding south from Humeganj at Etawah through the cutting leading to the Jumna, one observes on one's right hand (*i. e.* east), crowning an isolated mound, an old mosque. By those accustomed to the originally converted mosques of an early period, and as seen at Jaunpur and Benares, this may be at once recognized to have been altered from an ancient Hindu or a Buddhist structure by the process so well described by Fergusson in his *Handbook of Architecture* p. 81, vol. 1.—The style of the screen before the dome is the same as that at Jaunpur,\* whilst the round buttresses at the back, and the coeval ornamentation, fix the period of its conversion.

On enquiring from some of the more intelligent, I found the age of the temple to be popularly reported to be coeval with that of Etawah city. Thus  $5 \times 6 \times 1 \times 400 \times 1 = 413$  which being deducted from 1282 Hijra (new expiring) leaves 869, which deducted from 1866 A. D. leaves 997 A. D. which may very probably represent the real date of the *Hindu* erection.

As is often the case, there may have been a former temple, but the material, black kunkur, does not shew age well; whilst the granite-pillars have been altered and partially carved at different periods.

Mr. Hume of Etawah tells me he is about to publish a complete description of it with engravings; I therefore subunit these notes merely as the means of drawing attention to the building, which, taken in connection with other ancient remains, is worthy of a visit.

The main portion of the building is of black kunkur; although there are fragments of blue granite boulders in the walls, and portions of at least 10 granite columns of varying lengths. The average length of them is 5-6 with a thickness of 8 inches; but one at the gate, where it is used as an architrave, exceeds 7 feet. There are also plain pillars of red and light coloured sandstone.

I could not, in my short visit, ascertain whence the granite columns had been brought. They have, many of them, been cut in half, so that they now stand about 8'-3" in height; whilst one from which the carving

\* Atallah, Jumma Masjid and other mosques.



has been chiselled is used as an architrave in a rude chapel. Others are doubtless plaistered over in the walls.

The screen is 47 feet in height and a little less in width. The general depth of the building, of which a plan to scale is appended, (vide Plate III.) is 20 feet interiorly, the centre portion, on which the Mussulman dome is built, being a few feet more. The block of granite, perhaps 5 feet by  $1\frac{1}{2}$ , let into the front of the screen—and figured by me—is very curious. It is undoubtedly of great antiquity, and bears the usual Buddhist character of ornamentation as found in this neighbourhood. It at once attracts attention by being altogether out of place. Only one of the “Kangurá” or pinnacles remains in the building, but they doubtless extended across to the screen, the small portions of wall where the plaister has fallen, shew the well known scroll denticulated pattern.

Over the south chapel, right across the centre, has been constructed an arched chamber, 20 feet by 20, and perhaps 18 feet high. The roof of this has been moulded with pieces of nodular kunkur set in lime, which alone appears to keep it together. The effect is most singular; facing as it does to the East, it would seem that originally there had been a cloister, the four rude chapels consisting of 16 pillars each, with a larger chapel in the centre for the image. As, however, the whole was rebuilt by the Mussulmans some 430 to 450 years since, the only archaeological interest which attaches to the spot is, that it was undoubtedly once a Buddhist site.

In the court-yard, now enclosed by a mean brick wall, is a small chaitya, 9 feet square, covering a Mussulman tomb, where four plain pillars support a flat roof with cave-stones of red sandstone projecting 2 feet on each side. The stones composing this evidently came from Agra from the same quarries\* which furnished the Rajá's Secundra gardens. I have drawn one of the capitals which is of the old pattern, somewhat altered.

On the road between Etawah and Mynpoorie, several villages built on high “kheras” or mounds attracted my notice. I hope to explore them and send you the results, if any there be.

\* Tautpur Village, Sahender Pergunnah, Agra Zillah,

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*Translation of an Inscription copied in the temple of Nakhon Vat  
• or the City of Monasteries, near the capital of ancient Kambodia.*

—By Dr. A. BASTIAN.

[Received 16th January, 1867.]

The magnificent monuments of Kambodia give testimony of a by-gone civilisation, whose origin remains shrouded in mystery. Their history will be read by the stone-sculptures which cover the walls and portray the nations anciently inhabiting the country, their costumes, manners and customs. There is, besides, scattered over the ruins, a not inconsiderable number of inscriptions to be found, which are written in an antiquated kind of Pali character, and, when deciphered, may assist to obtain the right clue. The following inscription is a more modern one in Kambodian letters, and was copied inside the great temple at Nakhon Vat.

Sapphamasadu: Glory to the holy ones. In the year, which counts 1623 in the era, the year of the dragon, the third month, on a Thursday, in concordance with the Gatha, which are written in Pali, in the metrum of Phrohma-Kit, on the Phra-Phuttha Rub (the statue of Buddha,) I humbly offer up flowers to Bhagavat, who sits in meditation to observe the precepts (Sila), in the reflecting posture and undisturbed by the attacks of man (Mara or Satan), on the handsome seat of the Lotus (Phuttang). I offer up to the Pharabat (the holy footstep) of highest excellence. I bend down and raise hands in supplication at the feet of the Lord. I worship in my mind the three jewels (Ratana-trai), laying down flowers and areca on the throne-seat (banlang), which, elegantly ornamented by sculptures, is overhung in fourteen folds with the Baldachin of four kinds of clothes, beautiful all over in perfection, and the whole shining in brilliant splendour, as a cover of Phra-Photisat (the holy Bodhisatwa), who sits motionless in the posture of continual meditation. I present offerings to Sakhya-Muni, the Lord of glory, who has preached the true law for guiding all beings on the heavenly road. I do homage under the holy footstep. I worship and adore, raising the hands in supplication before the Lords of religion, the five Buddhas, the three gems: in humble piety I invoke them, devoutly I pray. I offer myself in holy love, never forgetting. I fix my mind, the whole of my mind and soul, on

the Phra-Chedi (the holy Chaitya or Pagoda) Chulamani\* (the precious diadem of hair) in Traidungsa (Daodungsa or the heaven of setting stars), encircled by the shephada (Devada), whom I reverentially bear on my head. I offer up and bow down before (the figure of) Phra-Patima in his golden abode, the Lord of the three praises, the refuge of all beings. I present offerings to the Phra-Phuttha Rub in the Phra-Sathub (Dagoba) of the Phra-Chedi (Pagoda), the Prasat (palace) of the Vihan (monastery). I present myself in offerings of humble service,—I present myself wholly and entirely.

Having done worshipping, having finished the offerings, I pray to become perfect in wisdom, to know all kinds of sciences without error and mistake, after having been born in the next existence for seven years. When I shall have accomplished all knowledge of letters, I pray that I may become well versed in the Trai-Pidok, that I may be able to answer every one's questions, to solve all riddles proposed, that I may know the Trai-Phet (three Vedas) and the Sinlaprasta (the magic of the stones). May I be blessed to meet Pra Sijahn (Sri-Ariya or Arimathiya, the future Buddha) in the next existence. May I be surrounded by numberless attendants; if 11,110 follow, it will be enough. May I be so shiningly beautiful, as to move all hearts, like those women, who having taken holy orders, shall be reborn relucet of radiant beauty, in recompense for their pious deeds, and by virtue thereof. May I become great and mighty, of such power, that even Phra-Phrohm (Brahma) could never put any obstacles in my way. And when the circle of transmigrations leads me to be reborn again in a new existence, I pray, that I may become Buddha, and attain the holy law, pervading all existence,—that I may become equal to the perfected ones in the world.

Now in regard to these people here, who are called respectively Ming, Behn, Sok by their surnames, they desire to become handsome and delicate in figure, of such a shape, as it makes women beloved. This prayer I put in, on behalf of the aforesaid persons of the village Tabungkram. And two of them, Ming and Behn, have still another wish in their heart, namely: to become rich in honours and dignities, beautiful like painted pictures. May they, on leaving the present existence, which is an imperfect and unsatisfactory one to them, may

\* Built by Indra over Gautama's hair, which he cut off with his sword.

they hereafter be reborn as brothers, and may the sinful consequences which have separated them, be exhausted, so that they will remain together and united always, and that ultimate death shall take them away simultaneously at one and the same day with their wives. May there be no grief, no sorrow then, as now oppresses them, now in the present existence, when the bones of mother and child are buried under a Phra-Chedi, which is erected above them, as a meritorious work. May mother and child remain united in the next existence.

And furthermore, there is a person here, called Im, who has restored a venerable Phra (idol), which had fallen in ruins, and lay there all cut to pieces. It had broken its neck; its hands and feet were lost. He built it up anew, he mended it, he made it handsome and pretty. It was covered with gold, it was surrounded by other Phra, 137 in number. All these figures, great and small, were clothed in a twofold set of garments; they had their praises written upon them. And after that, meritorious works were performed in the Phra-Chedi, which also had been rebuilt and embellished. For five ordinations the expenses were paid, and a Phra of gold was placed in remembrance. A great deal of money has been expended, the monks have been loaded with presents, a Vihan and a preaching-hall have been adorned, a priest was helped on in his consecrations, a slave was liberated, and all the other works of merits cannot be counted: they are too numerous. How often alms have been given is beyond recollection; times innumerable presents were brought to the priests. And these priests, after having received their presents, have vouchsafed pardon for all faults committed, have promised indemnity from all misfortunes. I pray to the Lord, that happiness may be in store for me, and that in the coming existence I may enjoy my blissful state, without being pestered by people who are envious of it. May I go through the future existences, free of calamities, full of wisdom and knowledge. May no sickness befall me. May I happily live, joined to my wife and my children, and attain a high and serene age, not knowing mishaps. May the evil consequences of former sins not reach me, may I never be oppressed by poverty. May I remain liberated from hell for ever. May my thoughts, now small and narrow, expand in the next existence, that I may understand the precepts

(sila) well and thoroughly, that I may never break them, nor commit trespasses. May wisdom be with me always. May I never be in want of relations; nay, may I be blessed with many of them. May I possess plenty of servants. May no slanders pollute me. May I never do a stupid thing. May I speak kindly and softly to every one I chance to meet. May I be preserved from dealings with fools. May I never be born poor and indigent, but only in rich and noble families. May I well understand my business. May my memory be a good one. May nothing frightful happen to me. May nobody hate me. May the punishments, awaiting for sinful deeds of former vices, not hurt me. In speaking to nobles and monks, may my words be right and proper. Should animals be killed unknowingly, may I be pardoned. May there be an end of grief and sorrow. May I depart life, surrounded by my friends, not abandoned and alone. May the sins I might have committed in the present existence, not call for retribution in the next one. May I never be tempted to treat great men and learned teachers in an insolent and impudent manner. I beg pardon for all errors I might be guilty against the holy priesthood, Phra-Phuttha, Phra-Thamr (Dhamma). I beg pardon for all my faults. I beg pardon for any breach of the precepts. I beg pardon for rudeness and roughness of mind. I beg pardon, if ever I have fostered revenge. I beg pardon for lies I have spoken. May I be prosperous in every existence, and always meet with people of rank and dignity. I beg pardon for all errors, committed in words or in acts. May I be secured against evil and misfortunes in my next existences. May there be no terror, no fear and trembling. May never aristocratic tyrants bully me. May I never be threatened by enemies in any of the existences to come. May I not suffer complaints in the next existence, neither baldness nor elephantiasis. May no sores or ulcers disfigure my body. May I not be ugly. I beg pardon, if I have allowed to be tempted by bad inclinations. May evil never come upon me, neither now nor in future. May I always enjoy handsome women. May nothing bad cross my way. When this existence shall be finished, may there never be any more sorrow, may I roll in undisturbed bliss. May the sinful consequences of former deeds, may the torments threatening therefrom, be delayed and put off. May I be re-born handsome and fine. May I never be imprisoned,

never be bound nor fettered. As it is said in the verses of Phromakut "Hao kha ti di," and in the Pali, raising my hands, I pray for wisdom. I, a person, to whom they have given the name Xai, I pray, that all evils of old and of the past may be finished, that I may be renewed to preach the words of the Lord in the next existence, to lead all beings on the road to Niphan. May I enjoy blessedness countless numbers of years in the existences to come, and then, performing works of merit with virtuous mind, may I attain to Phra-Sian-Metray (Arimathia). May I be pervaded by benevolence all over, may I show a charitable disposition continually, till the beating of the heart shall cease. As long as blood and eyes remain, may I accomplish good works. May I always be of a joyful mind, resembling Phra-Vixa-Thon\* (Chea-tor) and always give alms to the Pret (Pretas), feeding them with blood and flesh. May the Shephada Kowand keep account of all the alms I give. May Phrohms likewise see them and be attentive to keep account. May I receive plenty of joy and felicity, in recompense for these alms. May it please one of the Shephadas to throw down a heavenly sword, because I ardently wish to cut my flesh and skin, to give it in alms piecemeal, to feed the Pret, that they may be satiated and get enough of it. May Phra-Phakava (Bhagavat) and Phra Thamr also know about all these virtuous deeds. May I become like Phra Siahn. I present flowers to Bhagavat and worship in offering them. May I know thoroughly all rules and precepts, like the Upaxa (the ordainer of novices). May I become guide to the beings, my contemporaries; may I be a leader to them in the Lord's religion, during my future existence. The present existence is an imperfect one, my frailties cause me to deviate from the road of truth; I pray for greater perfection in the next existence; I pray for wisdom, so as to penetrate all things, so as to surpass all other men; I pray for wisdom sufficient to solve all difficulties, for wisdom, equal to that of Neakkhasen (Nágasena or Nágárjuna), who with ease and without hesitation explained the questions and riddles put to him by Krom-Malin (Milinda). May the good works of former existences help me on to be re-born in a lucky state. May the Shephada come to my assistance and favour me. May I become benevolent, good-natured and liberal, free of avarice,

\* Alchymists adore him, as the possessor of the magic stone, consisting of solid mercury, which is supposed to convert base metals into gold.

may I feel disposed to give alms, to do virtuous and meritorious works incessantly. And furthermore I pray particularly to possess that special wisdom vouchsafed to Taminsheah when still in the state of man, that wisdom which enabled him to solve all the problems invented by Nonthea-Sack in Nirupai, when, overcome by the prince of meritorious glory, he was made his slave and inspired by fear, and followed him as his servant. Thus he became the prince Apangtirat; and then a prince called on the Lord Viroxar, who at command received the name of Manang-Taek, because he used coarse and repulsive words, and did not know to speak properly by reason of his having been a garrulous and talkative fellow in one of his former existences. May I obtain a virtuous mind like Phra-Demiah (Temi),\* who patiently bore all the trials his father put him to. I pray to obtain wisdom equal to that of Phra-Kala when born as Mahosot, whose wisdom, surpassing the wisdom of everybody else, being equalled by none, overcame Phra-Chulani. May I give alms, rich alms and freely, in the same spirit as Phra-Mund, as Phra Vetsandon and his lady (Nang) Matsi who faithfully followed him, equal to Nang Nontha, being born of the same mothers, children of the same parents in the course of different existences. And with great beauty were they gifted, and boundless knowledge was their share, till they entered heaven, in which I also pray to be received. Separated from my beloved ones in this sad existence, I hopefully wish to remain united to them, when reborn in my next existence, whether as animal or as man. May I always be surrounded by truthful friends. May I always possess my children and relations. May I always see before me those good women, Nang Pus and Nang Behn, and then these men here, Sues and Pho and Im and Png. I wish in my prayers to be endowed with mighty power and authority, to be learned in magic arts, well versed in them like unto Phra Isor, who called back to

\* The Buddhists distinguish the lesser existences, 550 in number, from the greater ones, of which they count 50. The former contain the framework of those fables, which in various compilations have travelled far and wide through western nations. Of the greater existences, in which the Bodhisatwa has taken human form, the ten of the Thosse-Xat are especially venerated and the most holy one is the last Tataka, that of Phra Vetsandon, as immediately preceding the incarnation of the Buddha. These ten existences begin with the history of Temi, a pious child, who, when still in the cradle, imposed on himself ascetic penances.

life Nang Phakavadi, reviving her (by the ceremony of Xub).<sup>\*</sup> May my fame spread about in eminent renown like that of Phra Noray (Náráyana or Vishnu), who, coming down from heaven (ravan), was born in the state of man as Phra-Ram (Ráma) and subjected the Sack (Rakshasa) of Langká, walking through the air like Phra Tsun in Kailása. And then I wish to become a king and to get crowned, and to have nine handsome ladies as queens on my side, and to reign one hundred thousand years. And furthermore I pray for great strength and for beauty like that possessed by Phra Chan (Chandra or the moon) in times of old. May I possess prowess and a valiant heart, like Phra-Ram, the celestial one. I pray for wisdom to understand the Sinlaprasat, to know the whole of the military arts and warlike exercises like the exalted Phra-Ram, to be expert like him in archery. When this existence will be finished, may I be re-born the son of a king. May I ascend to heaven like Phra Ketsamalea,<sup>†</sup> May I be favoured by Phra-Ta (Tadra). May he give orders to Phra-Plantsakam (Visvakarma) to build for me also a royal residence of unparalleled splendour on the edges of the forest. May my voice be a melodious one like that of the bird Karavek. May my wisdom expand. May I know all things and everything. May I become rich in silver and gold, in gems and precious stones. May I have abundance in clothes, in carpets, in pillows and dresses. May my retinue be formed by handsome ladies, graceful in figure and soft and delicate of colour, with legs of the shape of the Talaket flower. May I understand the whole sense of the Trai-Pidock.<sup>‡</sup> May I, always revelling in favourable breezes, in the twinkling of the eye, hit the right to be safe. May I never lose my knowledge, should even my body shuddering tremble in fear. May my friends be one hundred one thousand in

<sup>\*</sup> The magic art of Xub, which revives by sprinkling with enchanted water, is taught in the high academy of Takkasila (Taxasila); and it is an always recurring trait in the Indo-chinese romances, that young princes or the sons of wealthy Sethi travel to that famous city, to pass there some years as students. Another, but more dangerous method, in which fire takes the place of water, is known to the Rasi or Rishi, the hermits of the forest. The last king of Nokhon Tom, whom they offered to cure of leprosy, lost his life during the process.

<sup>†</sup> Phra-Ketsamalea (the head crowned with garlands) is the reputed founder of the splendid temple of Nakhon Vat. The legend makes him to be a son of Indra, and relates that his heavenly father sent Visakarma, the architect of the gods, to build on earth a palace after the model of that in which the angels pass their joyful lives.

<sup>‡</sup> The Buddhist Scriptures are contained in the three parts of the Pitaka, the Abhidhamma, the Vinaya and the Súra.



number. May I remain undisturbed in unceasing bliss. May youths, male and female, of handsome appearance, attend on me, 100,000 in number, singing melodiously in sweet voices. May I possess wealth in elephants, horses, buffaloes and oxen of the best kind, elegant carriages and swift boats, to use them in going abroad. I would be pleased if each of my followers carried a glittering sword, and, when they close up in procession, they should solemnly walk like Putpala. Thus it is becoming. May I be favoured with magnificent palaces, nine of them, all covered with gold. Let them have high towering spires\* rising above, glittering with jewels; let them be surrounded by colonnades, winding in three circles; let them be engraved everywhere with sculptures. On each gate have placed the Dragon king (Phaya Nokh),—place him on each step of the stairs to guard them. There must be adjoined three dwelling-houses, handsomely and finely got up. The roof must ascend in three terraces, above each other, and all embellished with splendid ornaments. The round houses also may shine in splendid ornaments. A stable for elephants has to be built, nice and clean. Let there be halls on both sides of the lake, one at the right, the other one at the left, and have them decorated with garlands of the Champa-flowers, exhaling a sweet perfume, like the scented powder of Kracheh. That is all.

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#### LITERARY INTELLIGENCE.

Professor J. G. Bühler of the Elphinstone College, Bombay, and R. West, Esq. C. S. Acting Judge of Canara, have just brought out the First Book of "a Digest of Hindu Law," from the replies of the Cāstris in the several courts of the Bombay Presidency. The volume before us contains a large mass of *responsa prudentum* in a variety of practical cases regarding the Hindu Law of inheritance as current in Bombay. It has been published under the auspices of the Bombay Government, and will prove a useful book of reference to lawyers. In the Introduction the editors have given an interesting account of the ancient Smṛitis.

The Government of Bombay has sanctioned the publication of an edition of the Āpastamba Dharma Sūtra with the Tīkā of Hara Datta. The work will be carried through the press under the editorship of Dr. G. Bühler.

\* The description of the wished for palace is taken from the example of that one in which the inscription was hung up, viz. the temple of Nakhon Vat.

A new translation of the *Sakuntalá* of Kálidása, by Professor Foucaux of the French Academy, has just been published in Paris. The work has been got up in imitation of Professor Williams's excellent edition of the same work, and is intended to popularise among French readers that master-piece of the Indian Drama.

The publication of the *Taittiriya Sañhitá* of the Black Yajur Veda has once again been brought to a stop. Dr. Roer, who first undertook this work, left India on account of ill-health after publishing only five fasciculi. On his return to this country, press of official duties prevented his resuming the task, and it was therefore made over to Mr. E. B. Cowell. That gentleman succeeded in the course of three years to publish fourteen hundred pages, when ill health obliged him to retire from India. Paṇḍita Rāmanārāyaṇa Vidyāratna, who succeeded him and brought out the first fasciculus of the 3rd volume, died in May last, after a protracted illness of six months. He was a Sanskrit scholar of a high order, and was earnestly devoted to the ancient literature of his country. He published several Bengali books, and edited, for the *Bibliotheca Indica*, the *Vedānta Sūtras* with the Commentary of Saṅkara, and the *Srauta Stūra* of Āśwalāyana.

We have to record the death of another Sanskrit scholar of great eminence; Paṇḍita Premachandra Tarkavāgiṇa died at Benares on the 14th of April last. He was Professor of Rhetoric in the Sanskrit College of Calcutta for over thirty years, and was esteemed as the most profound scholar of his time. He was the only Bengali Paṇḍita who had made the Prākṛita language a subject of critical study. Among his works may be noticed the commentary on the great epic of Kaviṛāja, the *Rāghava paṇḍaviya*, every verse of which had to be explained so as to form once a history of the race of Raghu and once that of the Pāṇḍavas. His commentaries on the first half of the *Naishada Charita*, and those on the *Sakuntalá*, the *Uttararāma Charita*, the *Anarghaṛāghava*, the *Chātupushpāñjali*, the *Mukunda-muktāvali*, the *Saptasati-sāra*, and the 8th chapter of the *Kumārasambhava* are well known. For the *Bibliotheca Indica* he edited the *Kāvyaḍarṇa* of Ṛṣi Paṇḍin with an original commentary. He has left unpublished a Sanskrit Dictionary, and four Cantos of a poetical life of Śalivāhana, from whom dates the Śaka era of India.



*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of June 1866.*

Latitude  $22^{\circ} 33' 1''$  North. Longitude  $88^{\circ} 20' 34''$  East.

Height of the Cistern of the Standard Barometer above the sea level, 18-11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Date.	Mean Height of the Barometer at 32° Fahr.	Range of the Barometer during the day.			Mean Dry Bulb Thermometer.	Range of the Tempera- ture during the day.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	°	°	°	°
1	29.610	29.662	29.548	0.114	89.9	99.2	83.0	16.2
2	.629	.682	.557	.125	87.4	98.0	79.6	18.4
3	.625	.678	.555	.123	87.8	98.4	79.2	19.2
4	.593	.647	.480	.167	88.9	98.2	81.4	16.8
5	.571	.628	.499	.129	90.2	98.4	83.4	15.0
6	.509	.557	.404	.153	90.4	98.6	84.0	14.6
7	.494	.551	.431	.120	91.1	99.8	84.2	15.6
8	.551	.612	.479	.133	91.4	101.6	83.6	18.0
9	.570	.622	.497	.125	90.5	97.8	82.0	15.8
10	.546	.621	.447	.174	89.5	98.6	76.2	22.4
11	.503	.573	.423	.150	88.3	96.8	80.2	16.6
12	.499	.550	.425	.125	89.1	95.6	85.4	10.2
13	.532	.604	.462	.142	89.4	98.4	83.0	15.4
14	.538	.596	.450	.146	89.9	98.2	84.6	13.6
15	.492	.544	.440	.104	83.4	86.5	80.8	5.7
16	.494	.533	.443	.090	83.3	87.3	79.6	7.7
17	.515	.571	.451	.120	82.2	85.0	79.6	5.4
18	.531	.575	.476	.099	82.9	87.2	78.4	8.8
19	.503	.563	.436	.127	82.7	86.8	80.0	6.8
20	.425	.485	.350	.135	84.3	89.0	81.8	7.2
21	.375	.416	.319	.097	80.9	82.4	79.0	3.4
22	.429	.519	.365	.154	82.1	89.2	79.0	10.2
23	.502	.557	.446	.111	83.3	90.8	79.4	11.4
24	.483	.545	.403	.137	82.9	87.8	79.6	8.2
25	.441	.489	.380	.109	85.7	91.2	81.8	9.4
26	.431	.477	.376	.101	85.3	89.5	81.2	8.3
27	.465	.520	.415	.105	83.3	85.1	80.6	4.5
28	.514	.579	.452	.127	84.1	88.6	82.0	6.6
29	.573	.637	.503	.134	87.2	93.4	83.4	10.0
30	.607	.667	.560	.107	83.9	87.4	81.9	5.6

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of June 1866.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

Date.	Mean Wet Bulb Ther- mometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humi- dity complete satu- ration being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
1	82.2	7.7	77.6	12.3	0.928	9.83	4.63	0.68
2	80.7	6.7	76.7	10.7	.902	.58	3.87	.71
3	81.0	6.8	76.9	10.9	.908	.64	4.04	.71
4	82.7	6.2	79.0	9.9	.970	10.29	3.75	.73
5	83.7	6.5	79.8	10.4	.995	.54	4.05	.72
6	83.1	7.3	78.7	11.7	.961	.16	.51	.69
7	84.1	7.0	79.9	11.2	.998	.54	.43	.70
8	83.6	7.8	78.9	12.5	.967	.20	.90	.68
9	82.8	7.7	78.2	12.3	.946	.00	.72	.68
10	82.4	7.1	78.1	11.4	.943	.00	.29	.70
11	81.6	6.7	77.6	10.7	.928	9.85	3.95	.71
12	83.2	5.9	79.7	9.4	.992	10.53	.79	.75
13	83.0	6.4	79.2	10.2	.976	.35	.90	.73
14	82.8	7.6	77.7	12.2	.931	9.86	4.60	.68
15	80.6	2.8	78.6	4.8	.958	10.28	1.68	.86
16	80.1	3.2	77.9	5.4	.937	.06	.87	.84
17	79.7	2.5	77.9	4.3	.937	.08	.46	.87
18	79.5	3.4	77.1	5.8	.913	9.80	.99	.83
19	80.5	2.2	79.0	3.7	.970	10.42	.30	.89
20	80.6	3.7	78.0	6.3	.940	.07	2.21	.82
21	78.8	2.1	77.3	3.6	.919	9.90	1.20	.89
22	79.9	2.2	78.4	3.7	.952	10.23	.28	.89
23	80.4	2.9	78.4	4.9	.952	.21	.72	.86
24	79.9	3.0	77.8	5.1	.934	.03	.76	.85
25	80.3	5.4	76.5	9.2	.896	9.57	3.23	.75
26	80.4	4.9	77.0	8.3	.910	.73	2.91	.77
27	81.2	2.1	79.7	3.6	.992	10.63	1.30	.89
28	81.7	2.4	80.0	4.1	1.001	.72	.49	.88
29	81.0	6.2	77.3	9.9	0.919	9.78	3.59	.73
30	79.8	4.1	76.9	7.0	.908	.72	2.41	.80

All the Hygrometrical elements are computed by the Greenwich Constants.

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taken at the Surveyor General's Office, Calcutta,  
in the month of June 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Hour.	Mean Height of the Barometer at 32° Falt.	Range of the Barometer for each hour during the month.			Mean Dry Bulb Thermometer.	Range of the Tempera- ture for each hour during the month.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	°	°	°	°
Mid- night.	29.532	29.646	29.407	0.239	83.4	87.2	79.2	8.0*
1	.518	.630	.397	.233	83.2	87.0	79.2	7.8
2	.507	.621	.383	.238	83.0	87.0	79.2	7.8
3	.500	.633	.367	.266	82.8	86.8	78.8	8.0
4	.497	.641	.365	.276	82.7	86.8	78.4	8.4
5	.507	.644	.365	.279	82.7	86.4	78.8	7.6
6	.524	.651	.379	.272	82.7	86.6	79.0	7.6
7	.539	.664	.397	.267	83.7	88.0	80.0	8.0
8	.553	.678	.397	.281	85.2	90.8	80.6	10.2
9	.561	.676	.396	.280	86.9	95.0	81.0	14.0
10	.561	.682	.394	.288	88.5	97.2	80.4	16.8
11	.552	.676	.379	.297	89.8	98.6	80.6	18.0
Noon.	.539	.651	.362	.289	90.9	100.6	81.3	19.3
1	.520	.632	.352	.280	91.6	101.6	82.4	19.2
2	.499	.618	.339	.279	91.9	101.2	81.6	19.6
3	.481	.579	.329	.250	91.9	101.0	80.8	20.2
4	.463	.565	.319	.246	91.0	100.2	80.4	19.8
5	.459	.552	.323	.329	90.0	98.2	81.0	17.2
6	.475	.578	.343	.235	88.2	95.2	81.4	13.8
7	.500	.601	.362	.239	85.9	92.7	76.2	16.5
8	.520	.614	.382	.232	85.1	90.8	79.4	11.4
9	.538	.656	.401	.255	84.4	89.8	79.0	10.8
10	.549	.651	.411	.240	83.9	88.4	79.2	9.2
11	.547	.656	.416	.240	83.5	87.8	79.4	8.4

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

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taken at the Surveyor General's Office, Calcutta,  
in the month of June 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

Hour.	Mean Wet Bulb Ther- mometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of Vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humi- dity, complete satura- tion being unity.
	°	°	°	°	Inches.	T. gr.	T. gr.	
Mid- night.	80.3	3.1	78.1	5.3	0.943	10.12	1.84	0.85
1	80.3	2.9	78.3	4.9	.949	.18	.71	.86
2	80.5	2.5	78.7	4.3	.961	.33	.49	.87
3	80.5	2.3	78.9	3.9	.967	.39	.36	.88
4	80.5	2.2	79.0	3.7	.970	.42	.30	.89
5	80.6	2.1	79.1	3.6	.973	.45	.27	.89
6	80.6	2.1	79.1	3.6	.973	.45	.27	.89
7	81.1	2.6	79.3	4.4	.979	.51	.56	.87
8	81.4	3.8	78.7	6.5	.961	.26	2.35	.81
9	81.8	5.1	78.7	8.2	.961	.24	3.01	.77
10	82.0	6.5	78.1	10.4	.943	.02	.86	.72
11	82.3	7.5	77.8	12.0	.934	9.89	4.53	.69
Noon.	82.8	8.1	77.9	13.0	.937	.90	.99	.67
1	82.9	8.7	77.7	13.9	.931	.82	5.37	.65
2	83.1	8.8	77.8	14.1	.934	.85	.47	.64
3	82.9	9.0	77.5	14.4	.925	.76	.56	.64
4	82.9	8.1	78.0	13.0	.940	.93	.00	.67
5	82.5	7.5	78.0	12.0	.940	.95	4.55	.69
6	82.2	6.0	78.6	9.6	.958	10.17	3.59	.74
7	80.9	5.0	77.4	8.5	.922	9.83	.04	.76
8	80.4	4.7	77.1	8.0	.913	.76	2.81	.78
9	80.0	4.4	76.9	7.5	.908	.70	.61	.79
10	80.1	3.8	77.4	6.5	.922	.87	.26	.81
11	80.2	3.3	77.9	5.6	.937	10.04	1.96	.84

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of June 1866.*

•Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Gauge 5 feet above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	°	Inches		lb	
1	136.0	...	S. & S. S. E.	0.80	Clear to 5 A. M. Scatd. \i to 9 A. M. Scatd. \i to 4 P. M. Clear afterwards.
2	132.0	0.32	S. S. E. & S.	2.00	Clear to 5 A. M. Scatd. \i to 4 P. M. Overcast afterwards. Thunder & Lightning at 6, 7 & 9 P. M. Rain from 5 to 9 P. M. Clear afterwards.
3	137.0	...	S. & S. E.	1.25	Overcast to 5 A. M. \i to 6 P. M. Clear afterwards.
4	135.0	...	S. by E. & S.	5.00	\i to 10 A. M. clear to 3 P. M. Overcast afterwards. Lightning to the E. at 9 P. M.
5	130.0	...	S. & S. S. W.	1.25	Scatd. \i to 11 A. M. Scatd. \i to 5 P. M. Overcast afterwards. Lightning to the N at 7 & 8 P. M.
6	...	...	S. S. W. & S.	4.25	Clouds of various kinds. Thin rain at 9 P. M.
7	130.0	...	S. S. E. & S.	2.00	Clear to 3 A. M. Scatd. \i to 5 P. M. \i & \i afterwards.
8	132.0	...	S. by E. & variable	3.00	\i to 6 A. M. Thin clouds to 10 A. M. Clear to 5 P. M. Overcast afterwards. Lightning to N. E. at 8 & 9 P. M. Thunder at 8 P. M. Light rain at 10 & 11 P. M.
9	135.0	0.15	S. W. & S.	3.00	Overcast to 3 A. M. Scatd. \i & \i to 5 P. M. Overcast afterwards. Lightning at 8 & 10 P. M. Thunder at 10 P. M. Rain at 9 P. M.
10	128.0	0.24	S. & S. S. E.	23.00	Overcast to 4 A. M. Scatd. \i & \i to 5 P. M. Overcast afterwards. Rain from 7 to 9 P. M.
11	126.0	...	E. & S. S. E.	0.25	Scatd. \i to \i to 10 A. M. \i to 7 P. M. Overcast afterwards. Lightning to the N. at 8 P. M.
12	128.0	...	E. S. E. & variable.	0.30	Overcast to 8 A. M. \i to 7 P. M. Clear afterwards. Thunder at 3 P. M. Thin rain from 7 to 9 A. M. & at 3 P. M.
13	136.0	...	E. N. E. & S. & E.	0.50	Clear to 4 A. M. \i to 8 A. M. Scatd. \i afterwards. Lightning to the N. at 9 & 10 P. M.
14	131.0	...	E. S. E. & S. E.	0.50	Overcast to 3 A. M. Scatd. \i to 7 P. M. Clear afterwards. Lightning to the N. at 1 A. M.



*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of June 1866.\**

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Gauge 5 feet above Ground.	Prevailing direction of the Wind.	Max. sure of	General aspect of the Sky.
	o	Inches		lb	
15	...	0.38	E. S. E. & E.	0.80	Clear to 4 A. M. \i to 11 A. M. Overcast afterwards. Thunder at 1 P. M. Rain at 6 & 9 A. M. & from 1 to 5 P. M.
16	...	0.18	S. E. & E. by S.	0.80	Clear to 3 A. M. Overcast afterwards. Thunder at 7 A. M. Rain at 5, 6 & 7 A. M. & at 2 P. M.
17	...	0.53	S E & S S E & S by E	0.90	Overcast. Light rain from 2 to 9 A. M. & at 1 and 2 P. M. Lightning at 2, 3, & 4 A. M. Thunder at 2 & 11 A. M.
18	...	...	S.S.E.&S.S.W.&W.	0.50	\i & \i to 7 P. M. Overcast afterwards. Light rain at 11 A. M.
19	...	0.23	W. & S. W.	0.40	Overcast. Light rain after intervals.
20	...	{ *	W. S. W.	0.40	Overcast. Thin rain at 3 A. M. & from 7 to 11 P. M.
21	...		W. by S. & W. N. W.	0.60	Overcast. Light rain after intervals.
22	...	0.58	W. N. W. & S.	0.80	Overcast to 5 A. M. \i & \i to 1 P. M. Overcast to 7 P. M. Clear afterwards. Rain at 3, 4 & 7 P. M.
23	121.0	2.41	S. S. W. & W.	0.80	\i to 3 A. M. Overcast to 11 A. M. \i to 4 P. M. Overcast afterwards. Rain at 5 & from 8 to 11 P. M. Thunder & Lightning at 8 & 9 P. M.
24	...	0.28	W. by S. & W. S. W.	0.80	Overcast nearly the whole day. Light rain from 6 to 11 A. M.
25	117.0	...	W. S. W. & W. by S.	0.40	Clear to 5 A. M. \i to 9 A. M. \i to 3 P. M. Overcast afterwards. Slight rain between 2 & 3 P. M.
26	117.8	...	S. W. & W. N. W.	0.40	\i & \i to 6 P. M. Overcast afterwards. Slight rain at 3, 10, & 11 P. M.
27	...	0.64	W. S. W. & N. N. W.	1.25	Overcast rain at 1, 4, 5 & from 7 to 9 A. M. & at 8 P. M.
28	...	...	W. S. W. & S. W.	0.50	Overcast. Slight rain at 6, 10 & 11 A. M.
29	126.0	...	W. by S. & N. N. W.	0.50	\i to 3 A. M. Overcast to 7 A. M. \i & \i to 5 P. M. Overcast afterwards.
30	...	0.12	W. by N. & variable	0.50	Overcast to Noon. \i, to 5 P. M. Thin clouds afterwards. Rain at 6 & 7 A. M.

\i Cirri, — i Strati, \i Cumuli, \i Cirro-strati, ~i Cumulo strati, ~i Nimbi, ~i Cirro cumuli.

\*Fell from 7 P. M. of the 20th to 10 P. M. of the 21st.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta, in the  
month of June 1866.*

MONTHLY RESULTS.

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	Inches.
Mean height of the Barometer for the month, ...	29.518
Max. height of the Barometer occurred at 10 A. M. on the 2nd, ...	29.682
Min. height of the Barometer occurred at 4 P. M. on the 21st, ...	29.319
<i>Extreme range</i> of the Barometer during the month, ...	0.363
Mean of the daily Max. Pressures, ...	29.575
Ditto ditto Min. ditto, ...	29.449
<i>Mean daily range</i> of the Barometer during the month, ...	0.126

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Mean Dry Bulb Thermometer for the month, ...	86.4
Max. Temperature occurred at 1 P. M. on the 8th ...	101.6
Min. Temperature occurred at 7 P. M. on the 10th ...	76.2
<i>Extreme range</i> of the Temperature during the month, ...	25.4
Mean of the daily Max. Temperature ...	92.8
Ditto ditto Min. ditto, ...	81.3
<i>Mean daily range</i> of the Temperature during the month, ...	11.5

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Mean Wet Bulb Thermometer for the month, ...	81.4
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer, ...	5.0
Computed Mean Dew-point for the month, ...	77.9
Mean Dry Bulb Thermometer above computed mean Dew-point. ...	8.5

	Inches.
Mean Elastic force of Vapour for the month, ...	0.937

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	Troy grains.
Mean Weight of Vapour for the month ...	9.98
Additional Weight of Vapour required for complete saturation, ...	3.08
Mean degree of humidity for the month, complete saturation being unity 0.76	

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	Inches.
Rained 21 days,—Max. fall of rain during 24 hours ...	2.41
Total amount of rain during the month, ...	7.02
Total amount of rain indicated by the Gauge attached to the anemometer during the month. ...	6.25
Prevailing direction of the Wind, ... S. S. E. & S. & W. S. W.	

### MONTHLY RESULTS.

**Tables shewing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.**

[illegible]

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of July 1866.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Date.	Mean Height of the Barometer at 32° Fah.	Range of the Barometer during the day.			Mean Dry Bulb Thermometer.	Range of the Tempera- ture during the day.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	°	°	°	°
1	29.602	29.642	29.551	.091	77.7	81.0	75.6	5.4
2	.597	.646	.537	.109	76.2	77.8	75.2	2.6
3	.569	.613	.517	.096	79.1	85.6	74.4	11.2
4	.538	.576	.476	.100	81.2	85.4	78.0	7.4
5	.529	.580	.484	.096	81.3	86.6	77.4	9.2
6	.604	.665	.564	.101	81.6	87.6	78.4	9.2
7	.635	.698	.570	.128	83.2	89.0	79.8	9.2
8	.572	.634	.482	.152	85.1	93.0	80.0	13.0
9	.520	.575	.433	.142	85.8	93.2	80.6	12.6
10	.494	.547	.436	.111	86.2	91.6	83.2	8.4
11	.505	.558	.441	.117	85.1	90.5	81.0	9.5
12	.555	.616	.506	.110	84.5	90.0	81.0	9.0
13	.646	.697	.593	.104	84.6	89.8	81.2	8.6
14	.660	.714	.602	.112	85.0	90.4	80.2	10.2
15	.575	.651	.489	.162	83.4	86.0	81.2	4.8
16	.521	.560	.469	.091	84.2	86.7	82.0	4.7
17	.555	.597	.522	.075	83.2	91.0	78.6	12.4
18	.563	.600	.516	.084	82.9	86.2	80.4	5.8
19	.580	.631	.509	.122	83.3	88.6	79.0	9.6
20	.604	.654	.547	.107	82.3	86.0	80.2	5.8
21	.615	.662	.555	.107	82.7	86.8	79.2	7.6
22	.587	.634	.534	.100	83.4	87.0	79.8	7.2
23	.614	.664	.515	.119	84.5	89.4	80.0	9.4
24	.638	.681	.584	.097	84.6	87.8	81.8	6.0
25	.634	.670	.573	.097	84.0	90.4	81.6	8.8
26	.597	.645	.517	.128	82.2	85.0	81.2	3.8
27	.597	.639	.533	.106	83.7	88.6	79.2	9.4
28	.611	.668	.555	.113	83.2	87.5	80.4	7.1
29	.631	.691	.560	.131	84.3	90.2	79.8	10.4
30	.629	.673	.573	.100	84.8	90.8	80.3	10.5
31	.631	.668	.575	.093	83.0	87.8	80.6	7.2

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

# Meteorological Observations.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of July 1866.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon — (Continued.)

Date	Mean Wet Bulb Ther- mometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation	Mean degree of Humi- dity, complete satu- ration being unity.
	°.	°.	°	°	Inches.	T gr.	T gr	
1	75.3	2.4	73.6	4.1	0.817	8.86	1.24	0.88
2	75.0	1.2	74.2	2.0	.832	9.05	0.61	.94
3	77.0	2.1	75.5	3.6	.868	.38	1.15	.89
4	78.9	2.3	77.3	3.9	.919	.90	.31	.88
5	78.1	3.2	75.9	5.4	.879	.47	.77	.84
6	79.3	2.3	77.7	3.9	.931	10.02	.32	.88
7	80.4	2.8	78.4	4.8	.952	.21	.68	.86
8	81.0	4.1	78.1	7.0	.943	.08	2.49	.80
9	81.6	4.2	78.7	7.1	.961	.26	.57	.80
10	83.1	4.1	79.2	7.0	.976	.41	.58	.80
11	83.8	4.3	77.8	7.3	.934	9.99	.58	.80
12	80.1	4.4	77.0	7.5	.910	.73	.62	.79
13	80.6	4.0	77.8	6.8	.934	.99	.40	.81
14	80.7	4.3	77.7	7.3	.931	.96	.57	.80
15	81.2	2.2	79.7	3.7	.992	10.63	1.33	.89
16	81.4	2.8	79.4	4.8	.983	.51	.73	.86
17	80.4	2.8	78.4	4.8	.952	.21	.68	.86
18	80.1	2.8	78.1	4.8	.943	.12	.67	.86
19	80.3	2.5	79.0	4.3	.970	.42	.51	.87
20	80.4	1.7	79.4	2.9	.983	.56	.02	.91
21	80.4	2.3	78.8	3.9	.964	.36	.36	.88
22	80.2	3.3	78.0	5.4	.940	.09	.87	.84
23	81.4	3.1	79.5	5.3	.976	.45	.90	.86
24	81.5	3.1	79.3	5.3	.979	.48	.91	.86
25	81.1	2.9	80.1	4.9	.973	.42	.75	.86
26	80.3	1.9	78.0	3.2	.970	.44	.10	.89
27	80.3	3.4	77.9	5.8	.937	.04	2.03	.87
28	80.0	3.2	77.6	5.4	.934	.03	1.86	.87
29	80.7	3.8	76.2	6.1				
30	80.5	4.3	77.5	7.3				
31	79.4	3.1	77.7	5.3				

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All the Hygrometrical elements are











